

**2022**



**MULTI-JURISDICTIONAL**

**DRAFT  
11/18/2022**

**HAZARD  
MITIGATION  
PLAN**



**COCONINO COUNTY**

COCHISE COUNTY  
MULTI-JURISDICTION HAZARD MITIGATION PLAN – DRAFT 11/18/2022

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## **SECTION 1: JURISDICTIONAL ADOPTION AND FEMA APPROVAL**

### **1.1 DMA 2000 Requirements**

#### *1.1.1 General Requirements*

The Cochise County Multi-Jurisdictional Hazard Mitigation Plan has been prepared in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act), 42 U.S.C. 5165, as amended by Section 104 of the Disaster Mitigation Act of 2000 (DMA 2000) Public Law 106-390 enacted October 30, 2000. The regulations governing the mitigation planning requirements for local mitigation plans are published under the Code of Federal Regulations (CFR\_)Title 44, Section 201.6 (44 CFR §201.6). A DMA 2000-compliant plan that addresses flooding will also meet the minimum planning requirements for the Flood Mitigation Assistance program as provided for under 44 CFR §78.

DMA 2000 provides requirements for States, Tribes, and local governments to undertake a risk-based approach to reducing risks to natural hazards through mitigation planning<sup>1</sup>. The local mitigation plan represents the jurisdiction's commitment to reducing risks from natural hazards, serving as a guide for decision-makers as they commit resources to reduce the effects of natural hazards. Local plans will also serve as the basis for the State to provide technical assistance and prioritize project funding.

Under 44 CFR §201.6, local governments must have a Federal Emergency Management Agency (FEMA)- approved local mitigation plan to apply for or receive project grants under the following hazard mitigation assistance programs:

- Hazard Mitigation Grant Program (HMGP)
- The Building Resilient Infrastructure and Communities (BRIC) Program [Formerly the Pre-Disaster Mitigation (PDM)]
- Flood Mitigation Assistance (FMA)
- Repetitive Flood Claims Program (RFC)

#### *1.1.2 Update Requirements*

DMA 2000 requires that local plans be updated every five years, with each planning cycle requiring a complete review, revision, and approval of the plan at both the state and FEMA levels. Cochise County and the incorporated communities of Benson, Bisbee, Douglas, Sierra Vista, Tombstone, and Willcox were included in the 2017 Cochise County Multi-Jurisdictional Hazard Mitigation Plan (MJHMP). This Plan revision results from a multi-jurisdictional update process by the current signatories. The result of the planning process is a single, multi-jurisdictional plan that updates the countywide Plan of 2017.



## **1.2 Official Record of Adoption**

Adopting the Plan is accomplished by the governing body for each participating jurisdiction by the authority and powers granted to those jurisdictions by the State of Arizona. The officially participating jurisdictions in the Plan include:

- County
  - Cochise County
- Cities
  - City of Benson
  - City of Bisbee
  - City of Sierra Vista
  - City of Tombstone
  - City of Willcox
- Towns
  - Town of Huachuca City

A digital copy of each official adoption resolution is in Appendix A of the finalized Plan.

## **1.3 FEMA Approval Letter**

The Plan was submitted to the Arizona Department of Emergency & Military Affairs (ADEMA) as the authorized state agency, and to FEMA for review and approval. FEMA's approval letter is provided on the following page.

FEMA Approval Letter

## **SECTION 2: INTRODUCTION**

### **2.1 Plan History**

The last update to the Cochise County Multi-Hazard Mitigation Plan occurred in 2017. Beginning in the spring of 2022, Cochise County and the incorporated communities of Benson, Bisbee, Douglas, Huachuca City, Sierra Vista, Tombstone, and Willcox participated in a mitigation planning process that resulted in the development of an updated county-wide plan covering each participating jurisdiction. The County and several jurisdictions have been involved in mitigation planning since the early 2000s. Before the 2012 multi-jurisdictional plan, several jurisdictions in Cochise County developed mitigation plans on their own.

### **2.2 Plan Purpose and Authority**

The purpose of the Plan is to:

- Identify natural hazards that impact the various jurisdictions located within Cochise County,
- Assess the vulnerability and risk posed by those hazards to community-wide human and structural assets,
- Develop strategies for the mitigation of identified hazards,
- Present future maintenance procedures for the plan, and
- Document the planning process.

The Plan is prepared in compliance with the Disaster Mitigation Act of 2000 requirements and the Federal Emergency Management Agency's (FEMA's) Local Mitigation Planning Policy Guide 2022 and represents a multi-jurisdictional update of the 2017 county-wide Plan.

Cochise County and all of the Cities and Towns are political subdivisions of the State of Arizona. They are organized under Title 9 (Cities/Towns) and Title 11 (Counties) of the Arizona Revised Statutes (ARS). Each of these entities is empowered to formally participate and adopt the Plan on behalf of their respective jurisdictions.

Funding for the 2022 revision of the Plan was provided through a planning grant obtained by the State of Arizona from FEMA. BearPAL Consulting, LLC was retained by Cochise County to provide consulting services in guiding the planning process and revising the plan.

### **2.3 General Plan Description**

The Plan is generally arranged and formatted to be consistent with the Arizona 2018 State Hazard Mitigation Plan (State Plan) and the requirements of and is comprised of the following major sections:

- Community Descriptions – Provides descriptive overviews of the participating jurisdictions and the County.
- Planning Process – Summarizes the planning process used to update the Plan, including the development of the planning team, the meetings conducted, and the public involvement efforts.
- Hazards and Risk Assessment – This section identifies and profiles the natural hazards that impact the County as chosen by the planning team. Each hazard includes history, probability, extent, warning time, future conditions, exposure/loss estimations, and development trend analyses.
- Mitigation Strategy – Presents a capability assessment for each participating jurisdiction and summarizes the Plan mitigation goals, objectives, actions/projects, and strategy for implementing those actions/projects.
- Plan Maintenance Strategy – Outlines the proposed strategy for evaluating and monitoring the Plan, updating the Plan in the next five years, incorporating plan elements into existing planning mechanisms, and continuing public involvement.
- Plan Tools – Contains a list of Plan acronyms and a glossary of definitions.

### **2.4 Overall Plan Update Process**

The 2022 Plan results from a thorough update process that included a section-by-section review and evaluation of the 2017 Plan by the planning team participants. Table 2.1 summarizes the review and analysis of each section of the 2017 Plan and generally describes what changes were or were not made and why. Detailed descriptions of changes are discussed in the Plan sections.

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Table 2-1: Summary of 2022 and 2017 Plan Correlation		
2022 Plan Section	2017 Plan Section	Review and Changes Description (2017 Plan to the 2022 Plan)
1	1	<ul style="list-style-type: none"> <li>No significant changes occurred besides an updated FEMA Approval Letter in this section.</li> </ul>
2	2	<ul style="list-style-type: none"> <li>No significant changes occurred besides updates to current dates, documents, and processes in this section.</li> </ul>
3	3	<ul style="list-style-type: none"> <li>Community descriptions were updated with input from the participating jurisdictions.</li> <li>A description of the Fort Huachuca Army base was added.</li> <li>All maps were replaced for the Community Descriptions by County Geographical Information System (GIS).</li> <li>The Cochise County Historical Society updated the History section.</li> </ul>
4	4	<ul style="list-style-type: none"> <li>Planning process details were updated, including Planning Team participants and stakeholder contacts.</li> </ul>
5	5	<ul style="list-style-type: none"> <li>Each hazard was updated according to the FEMA Local Mitigation Planning Policy Guide 2022.</li> <li>FEMA's Hazard Risk Index was utilized during the hazard review process for several hazards.</li> </ul>
6	6	<ul style="list-style-type: none"> <li>Past mitigation actions were reviewed and updated, and new actions were added.</li> <li>Goals and objectives were reviewed and updated.</li> </ul>
7	7	<ul style="list-style-type: none"> <li>The description of the Plan Maintenance process was updated.</li> </ul>
8	8	<ul style="list-style-type: none"> <li>Minor revisions with corrected acronyms and definitions were moved to the main document.</li> </ul>
Appendixes	Appendixes	<ul style="list-style-type: none"> <li>Documentation updated, as applicable.</li> </ul>

## SECTION 3: COMMUNITY DESCRIPTIONS

### 3.1 General

This section provides updated background information on Cochise County and its jurisdictions and includes information on geography, history, climate, population, and economy.

### 3.2 County Overview

Cochise County is in the extreme southeastern corner of Arizona, sharing boundaries with the State of New Mexico on the east and Mexico on the south. Cochise County was created by an Act of the 11th Territorial Assembly in 1881 and was named after the Chiricahua Apache Chief Cochise. Much of the County was the homeland of the Chiricahua Apache until they were relocated to Florida and eventually to Oklahoma and New Mexico. Cochise County is now one of only three counties in Arizona without a Tribal presence. The County is currently comprised of 6,215 square miles, with the City of Bisbee serving as the County seat since 1929. The location of Cochise County relative to other counties within the State of Arizona is depicted in Figure 3-1.

#### 3.2.1 Geography

The County limits generally extend from longitude 109.05 to 110.47 degrees west and latitude 31.34 to 32.43 degrees north. Major roadway transportation routes through the County include Interstate 10, U.S. Highway 191 and State Routes 80, 82, 90, 92, 181, and 186. The Union Pacific Railroad (UPRR) has several lines servicing most of the County. Figure 3-2 shows the major roadway and railway transportation routes and the airports within Cochise County.

The San Pedro River is the largest watercourse flowing through the County. Other regional watercourses include the Babocomari River, San Simon River, and Whitewater Draw. The remaining watercourses are primarily ephemeral, with most tributaries to one or more regional rivers.

The geographical characteristics of Cochise County have been mapped into terrestrial ecoregions, which are depicted in Figure 3-3.



Figure 3-1. Vicinity Map



Figure 3-2. Transportation Routes Map

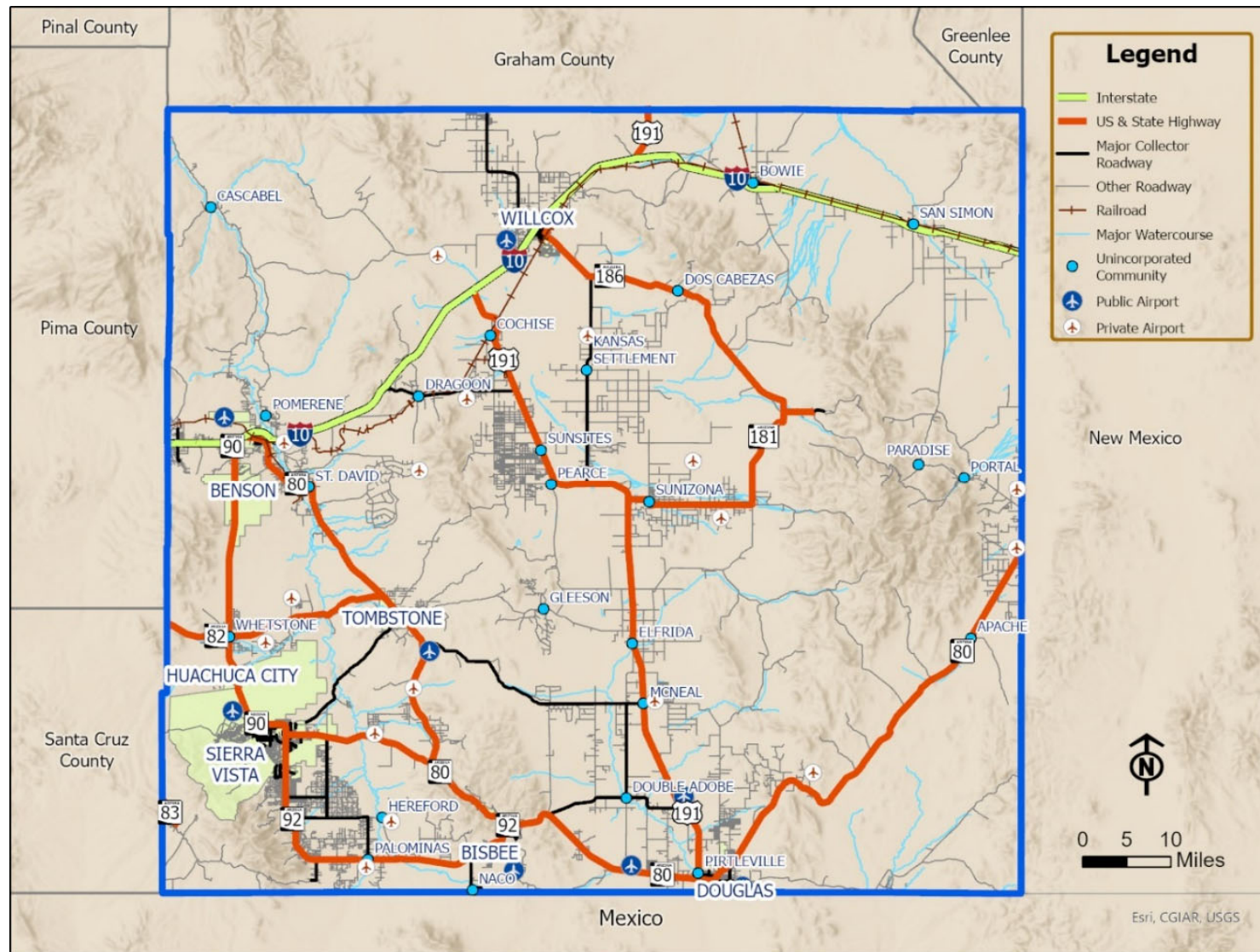
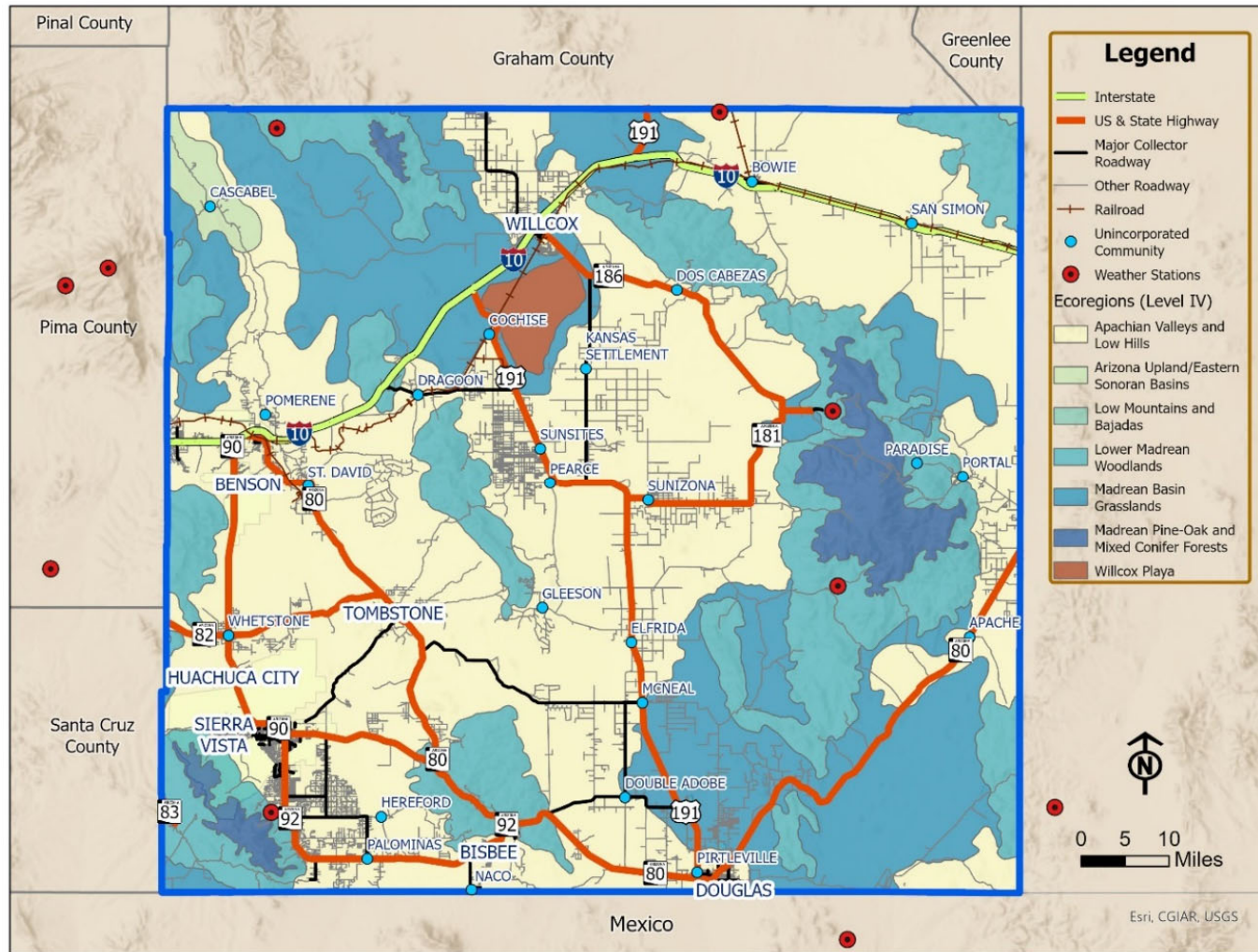




Figure 3-3. Terrestrial Ecoregions Map



### 3.2.2 History

The Cochise County area has been inhabited for at least 11,000 years by various indigenous tribes. There are many Mammoth hunt sites, especially along the San Pedro River, where Clovis spear points have been found embedded in Mammoth kills.

What would eventually become Cochise in 1881 began as part of the Gadsden Purchase from Mexico on June 8, 1854. Arizona territory separated from New Mexico in 1863, and Cochise County was carved out of Pima County by an act of the 11th Territorial Assembly on January 3, 1881. Arizona became the 48th state on February 14, 1912. It was named for the famed Apache Chief, Cochise, who made a treaty with the U.S. in 1872, died on June 8, 1874, and whose burial place in the Dragoon Mountains has never been found.

Tombstone, which was then touted to be the most cultured city in the entire West or Southwest, was the first town to incorporate and served as the county seat until 1929. Bisbee has served as the County seat from 1929 until the present. Arizona is famously known for its five Cs: Copper, Cattle, Climate, Citrus, and Cotton. Cochise County is still known for the first three of these.

In its heyday, the Copper Queen mine in Bisbee was Arizona's most productive copper mine. On July 12, 1917, in response to a strike, Phelps Dodge had 1300 men—miners, strikers, and others—arrested with the help of private deputies, loaded onto railroad cattle cars, and forcibly hauled several hundred miles into New Mexico. Although this was later deemed illegal, no one was ever punished. This is known as the Bisbee Deportation. *Bisbee '17* was a movie made in 2018 about the incident. It is part documentary, part re-enactment, and part dramatization, with many local Bisbee residents playing parts.

Cochise County has the highest percentage of private land of any county in the state at approximately 40%. Willcox was once one of the major cattle shipping points in the southwest. Cochise County is home to the largest areas of intact, high-quality native grasslands in the state and several sky island mountain ranges with peaks close to 10,000 feet. Ranching is still an important economic driver in the County.

Cochise County shares approximately 84 miles of border with Sonora, Mexico, and encompasses 6,219 square miles, the size of Rhode Island and Connecticut combined. There are still intact Spanish Land grants in Cochise County.

With elevations ranging from 3,000 feet where the San Pedro River crosses from Cochise County into Pima County to almost 9,800 in the Chiricahua Mountains, Cochise County boasts a year-round climate and attracts tourists from around the world for its history, birding, hunting, and camping.

Sierra Vista, the largest city, is also home to Fort Huachuca, an army post dating back to territorial days. It was the home of the Buffalo Soldiers, 10th Cavalry African American regiments from 1877 until 1913. Today Fort Huachuca is a significant economic driver for Sierra Vista and the County and houses several critically important missions. In 1967 it was named the Headquarters of the Army Communications Command, and since 1971 it has been home to the Army Intelligence Center and School. It also includes essential testing grounds for unmanned aircraft and is especially known for its pristine electronic testing range.

Fort Huachuca was one of the first three military installations in the U.S. designated by Congress as a Sentinel Landscape in 2015. The primary goal is to use collaborative, community-driven strategies to tackle issues such as water conservation, agricultural viability, wildlife habitat restoration, and military mission protection. Partners in Sentinel Landscape projects include USDA (U.S. Dept Agriculture), DOD (Dept of

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Defense), DOI (Department of Interior), and National, State, County, and Local agencies, indigenous and private conservation groups.

Table 3-1 lists the county's incorporated communities and their founding and incorporation dates.

Table 3-1: Founding and incorporation dates for incorporated communities in Cochise County		
Jurisdiction	Founding Date	Incorporation Date
Benson	1880	1924
Bisbee	1880	1902
Douglas	1901	1905
Huachuca City	1954	1958
Sierra Vista	1927	1956
Tombstone	1870	1881
Willcox	1880	1915

Historical development of the County has primarily been precipitated by either mining or agriculture. In 1880, the then Southern Pacific Railroad opened in Benson and later in Willcox. Both communities became bustling railroad towns and destinations to acquire supplies and ship goods.

### 3.2.3 *Climate*

Climatic statistics for weather stations within Cochise County are produced by the Western Region Climate Center and span records dating back to the early 1900s. Locations of reporting stations within or near Cochise County are shown in Table 3-2. Temperatures within Cochise County range from below freezing during the winter months to over 100 degrees Fahrenheit during summer. The severity of temperatures in either extreme depends on the location and, more importantly, the altitude within the County. The data in Table 3-2 is from climate stations found in geographically different areas of Cochise County. The station data represents temperature variability and rainfall extremes throughout the County.

Precipitation throughout Cochise County is significantly governed by elevation and season of the year. From November through March, storm systems from the Pacific Ocean cross the state as broad winter storms, which produce mild precipitation events with snowstorms at higher elevations. Summer rainfall begins early in July and usually lasts until mid-September. Moisture-bearing winds move into Arizona at the surface from the southwest from the Gulf of California and aloft from the southeast from the Gulf of Mexico. The shift in wind direction, termed the North American Monsoon, produces summer rains with thunderstorms resulting primarily from excessive land surface heating and the subsequent lifting of moisture-laden air, especially along the primary mountain ranges. Thus, the strongest thunderstorms are usually found in the mountainous regions of the central, southeastern portions of Arizona. These thunderstorms are often accompanied by strong winds, blowing dust, and infrequent hail storms.



Table 3-2. Climate Data for Stations in Cochise County								
Location	Average Temperature (F)				Precipitation (inches)			
	January		July					
	Min	Max	Min	Max	Wettest Month	Driest Month	Total Annual Average	Total Annual Snowfall
Benson (1894-1975)	28.8	63.0	65.7	96.4	2.79	0.10	11.34	1.80
Bisbee (1985-2016)	30.6	56.7	61.8	87.4	4.20	0.21	18.38	6.10
Douglas (1948-2016)	29.6	62.9	64.9	94.4	3.63	0.28	13.44	No data
Pierce Sunsites (1913-2016)	29.6	60.5	64.4	93.5	3.01	0.21	12.28	1.90
Sierra Vista (1982-2016)	33.5	61.1	65.9	91.7	3.75	0.27	13.99	0.60
Tombstone (1893-2016)	34.8	60.1	62.4	94.4	3.48	0.21	13.83	No data
Willcox (1898-2016)	25.9	58.7	53.6	94.4	2.52	0.26	12.18	3.40
Note: The period of record varies and is noted for each station. Source: Western Region Climate Center, 2022 URL: <a href="https://wrcc.dri.edu/">https://wrcc.dri.edu/</a>								

### 3.2.4 Population

According to the U.S. Census, the population of Cochise County was 125,447, down from 131,346 in the 2010 census. A majority of the citizens still live in the incorporated communities of Cochise County. The largest incorporated community is the City of Sierra Vista. Most of the six incorporated cities and one town are located on the county's western side. The City of Douglas is considered a border city and an important entry point into Mexico. The other non-incorporated communities throughout the county are usually situated along highways, and many consist of only one structure or landmark. Table 3-3 summarizes jurisdictional population statistics for the participating jurisdictions and unincorporated Cochise County.

Table 3-3. Jurisdictional population and estimates for Cochise County		
Jurisdiction	2010	2020
Cochise County Total Population	131,346	125,447
Benson	5,105	5,335
Bisbee	5,575	4,923
Douglas	17,378	17,378
Huachuca City	1,853	1,630
Sierra Vista	43,888	45,321
Tombstone	1,380	1,308
Willcox	3,757	3,213
Unincorporated County (calculated)	52,410	46,339
Source: U.S. Census Bureau. URL: <a href="https://www.census.gov/quickfacts/cochisecountyarizona">https://www.census.gov/quickfacts/cochisecountyarizona</a> and <a href="https://www.census.gov">https://www.census.gov</a>		

### 3.2.5 *Economy*

Cochise County is attractive to a variety of businesses because of some of these features:

- Six general aviation airports with available land.
- Robust fiber-optic infrastructure.
- Access to a major east-west freeway (Interstate 10) from all communities.
- Multiple electric cooperatives with reliable and cost-effective power and natural gas providers.
- Fertile agricultural land with a year-round growing season.
- Proximity to the Mexican border with two international ports of entry.
- Rail access.
- Seven hospitals for comprehensive healthcare.
- Higher education with campuses for Cochise College, the University of Arizona, and Wayland Baptist University throughout the County.
- Home of the U.S. Army Intelligence Center and the Army Network Enterprise Technology Command.

The largest employer in Cochise County has been and remains Fort Huachuca. The military, support staff, and contractors who support the Army Military Intelligence post consistently employ the most significant percentage of the workforce in Cochise County.

Agriculture continues to be an important segment of the Cochise County economy. Once known as the cattle capital of the nation, livestock continues to be important to the county's economy. Primary irrigated crops are cotton, wheat, corn, grain, sorghum, and alfalfa hay. More recent diversification of agriculture in Cochise County has resulted in changes from the primary crops to apples, peaches, cherries, grapes, pistachios, pecans, lettuce, chili, and other vegetables. The area has many you-pick vegetable farms and orchards with various produce and crops. The most significant regions for growing operations are the Sulphur Springs and San Simon Valleys.

As previously mentioned, Cochise County's climate is conducive to various activities and industries. The landscape responds to the climate with beauty and abundance. Cochise County attracts thousands of visitors annually who experience the region's rich cultural history and myriad outdoor recreation opportunities.

Cochise County's moderate Arizona climate offers many opportunities year-round for individuals and families to explore and enjoy. Outdoor activities include many state and federally-managed park areas, including the Chiricahua National Monument and Coronado National Memorial, as well as Kartchner Caverns State Park. The high elevation of the County makes these areas available and enjoyable to visit at any time. The natural wonders of Cochise County appeal to just about everyone with birding areas that offer a glimpse of some of the most fascinating species in the world, hiking and camping areas with breathtaking vistas of the rugged high-Sonoran beauty, along with the history and careful preservation that make these areas a treasure.

The many historic sites and museums in Cochise County offer a history lesson opportunity to visitors and residents alike. The 11,000-year-old Clovis and the Lehner-Mammoth Kill Site, where archeologists found mammoth bones, is probably the oldest representation of the county's past. Popular Native American history museums include the Amerind Foundation Museum and the Apache Warrior Cochise Mountain hideout, or "Cochise Stronghold." Cochise County is also rich in military history, and numerous sites throughout the County pay homage to the extensive military

history of the area, including the U.S. Army Military Intelligence Museum on Fort Huachuca. Finally, old west mining towns and ghost towns in Cochise County offer anyone a glimpse into a time in U.S. history marked by legends and mysteries.

The County has identified seven community planning areas for the unincorporated portion of the County. The following are summaries of each area from the Cochise County Comprehensive and Area Plans page and the Cochise County Comprehensive Plan (County, Cochise, 2022).

- Babocomari Community Plan – the Babocomari area is currently defined by the boundaries of the entire San Ignacio del Babocomari Land Grant east of Highway 90. The San Ignacio del Babocomari Land Grant (Babocomari or Land Grant) has been, largely and historically, a ranch that extends from the County's boundary with Santa Cruz County in the Huachuca Mountains along the Babocomari River, east for approximately 47 miles through Whetstone to the Presidential Estates, a residential community located east of the junction of S.R. 82 and S.R. 90.
- Elfrida Community Plan – this plan area encompasses the area along State Route 191, bordered by N. Bell Road to the east, Web to the north, and West Hedges Road to the south. This area was approved by the Board of Supervisors in December 2003.
- Mid-Sulphur Springs Valley Area – this plan area includes the Pearce Townsite, Sunsites Townsite, and surrounding rural areas. Exact boundaries are depicted on the Mid-Sulphur Springs Valley Community Development Map formally adopted by the Cochise County Board of Supervisors on November 15, 1999.
- Naco Area – the plan area boundaries encompass an area extending from one mile north of Purdy Lane, south to the Mexican Border, two miles east of Naco Highway, and two miles west of Naco Highway. The area includes the Naco Townsite, the golf course, Country Club estates, some rural development along Purdy Lane, vacant land, State land, a scattering of businesses, and land owned by Phelps Dodge.
- Southern San Pedro Valley – the plan area boundaries are consistent with the Palominas Fire District boundaries and are depicted on the Southern San Pedro Valley Area Plan.
- St. David Area – the St. David Area Plan would affect properties included within the following Township, Range, and Sections of the St. David area:
  - Township 17, Range 20, Sections 13, 24, 25, 34, 35, 36
  - Township 17, Range 21, Sections 13 through 36
  - Township 18, Range 20, Sections 1, 2, 11, 12, 13, 14, 23, 24, 25, 26, 35, 36
  - Township 18, Range 21, Sections 1 through 36, except those portions of Sections 26, 27, 34, and 35 that lie within the Curtis Ranch Master Development Plan (MDP).
- Tres Alamos Area – the plan area boundaries are specifically shown on the Tres Alamos Area Plan Map, adopted by the board. The plan boundaries generally follow the San Pedro River north of I-10 to Cascabel and encompass a three- to five-mile-wide swath.

According to the Arizona Commerce Authority<sup>1</sup>, as of September 2022, employment in Cochise County was 34,400, up 1.8% since last year, and is not seasonally adjusted. Twenty-three thousand nine hundred jobs are in the private sector, and the rest are in the public sector between federal, state, local, and military. Employment took a dip in the second quarter of 2020 throughout Arizona, which is assumed to be due to the pandemic, but the job market has recovered, and non-farm employment is steadily growing.

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<sup>1</sup> Arizona Commerce Authority. (2022). *Industry Employment and Wages*. Retrieved November 3, 2022, from <https://www.azcommerce.com/oeo/labor-market/industry-employment/>

As a significant employer in Cochise County, Fort Huachuca is a vital community member and resource. Fort Huachuca's mission has changed over the years with the implementation of the Base Realignment and Closure Act of 1988; the installation has transitioned into a multi-mission center for the U.S. Army. The current mission of Fort Huachuca is to provide standardized, effective, and efficient services, facilities, and infrastructure to Soldiers, Families, and Civilians for an Army and Nation engaged in persistent conflict. The mission contains the following major elements:

- Contingency Military Support
- United States Army Intelligence Center of Excellence (USAICoE)
- U. S. Army Network Enterprise Technology Command (NETCOM)
- 2-13 Aviation Battalion (Unmanned Aircraft Systems Training Center)
- U.S. Army Electronic Proving Ground (EPG)
- Intelligence Electronic Warfare Test Directorate (IEWTD)
- U.S. Army Information Systems Engineering Command (ISEC)
- Joint Interoperability Test Command (JITC)
- HUMMINT Training – Joint Center of Excellence (HT-JCOE)

Fort Huachuca is located approximately 15 miles north of the Mexico – United States Border in southeast Arizona. The Fort's elevation is approximately 4,500 feet at the cantonment (Main Post) and is geographically part of the Huachuca Mountains. The Huachuca Mountains consist of several peaks which extend above 8,000 feet, with Miller peak being the highest point topping out at 9,465 feet. The vegetation is a mix of conifers primarily consisting of pine and juniper at the upper elevation and oak at the mid-elevation, transitioning to grass and chaparral at the lower elevation.

Fort Huachuca's installation boundaries are adjacent to two rural counties – Cochise and Santa Cruz. Libby Army Airfield is encompassed within Fort Huachuca and is adjacent to the city limits of Sierra Vista. Numerous agreements are in effect with the surrounding local, county, and federal organizations for support and assistance.

Fort Huachuca is a Type II Installation possessing operations-level emergency management capabilities. For an all-hazards Army Emergency Management Program, the term "operations-level" includes the ability to effectively respond to and contain consequences from any natural, technological, or terrorism hazard the installation's mission or protected populace may be affected by. Type 2 installations have well-established current support agreements and organic capabilities and capacity to meet the requirements of Type 4–5 incidents. Typically, Type 2 installations have mutually supportive relationships with local jurisdictions.

### 3.3 Jurisdictional Overviews

The following are brief overviews of each of the participating jurisdictions in the Plan.

#### 3.3.1 Benson

Benson is located within the San Pedro Valley of Cochise County, Arizona, at an elevation of 3,585 feet. According to the City's website (City of Benson, 2022), Benson serves as the western gateway to the scenic and historical attractions of Cochise County. The City has copyrighted the name "Home of Kartchner Caverns State Park." The Benson city limits currently occupy approximately 40.3 square miles. The location of Benson within Cochise County is depicted in Figure 3-2.

The heart of Benson is generally located at 110.30 degrees west and latitude 31.96 degrees north. Major transportation routes through or near the city include Interstate 10 and State Routes 80 and 90. State Route 80, locally known as Fourth Street, serves as Benson's "Main" Street, connects Benson to Tombstone (19 miles to the southeast), and passes through the unincorporated community of St. David. State Route 90, which originates on the west end of Benson at Interstate 10 Exit 302, connects Benson to Sierra Vista and Fort Huachuca, 35 miles to the south. Kartchner Caverns State Park also lies south along State Route 90. The Union Pacific Railroad (UPRR) passes through the city, with the east-west line generally following the I-10 alignment and a line extending south. Benson is serviced by the public Benson Municipal Airport airport. Figure 3-4 shows all the major roadways, railway transportation routes, and airports within the vicinity of Benson.

The San Pedro River is the largest watercourse flowing through the city. Other significant watercourses flowing through or near Benson include the Cadillac, California, Middle Canyon, and Pacheco Washes.

The 2015 General Development Plan Technical Appendices<sup>2</sup> also provide a wealth of information summarizing Benson's economic and demographic characteristics. According to the General Plan, Benson was founded in 1880 as a transportation hub for both rail and overland travelers. The City was incorporated in 1924 and has continued to grow moderately. A complete discussion of the history of Benson is provided in General Plan Technical Appendices. The following bullets summarize the highlights:

- 1880 – the original townsite was founded and named after Judge William A. Benson, a friend of Charles Crocker, president of the Southern Pacific Railroad.
- 1913 – the Southern Pacific Railroad moved its hub to Tucson, which depressed the Benson economy. Ranching and agriculture picked up during this period.
- 1924 – Incorporation brought a municipal water system, city-franchised electric power, and a jail facility.
- 1926 – A new elementary school was constructed.
- 1929 – A new high school was constructed.
- 1930 – Construction of the Sunset Trail through Bowie, Willcox, and Benson spawned new vehicular traffic and businesses to serve that need.

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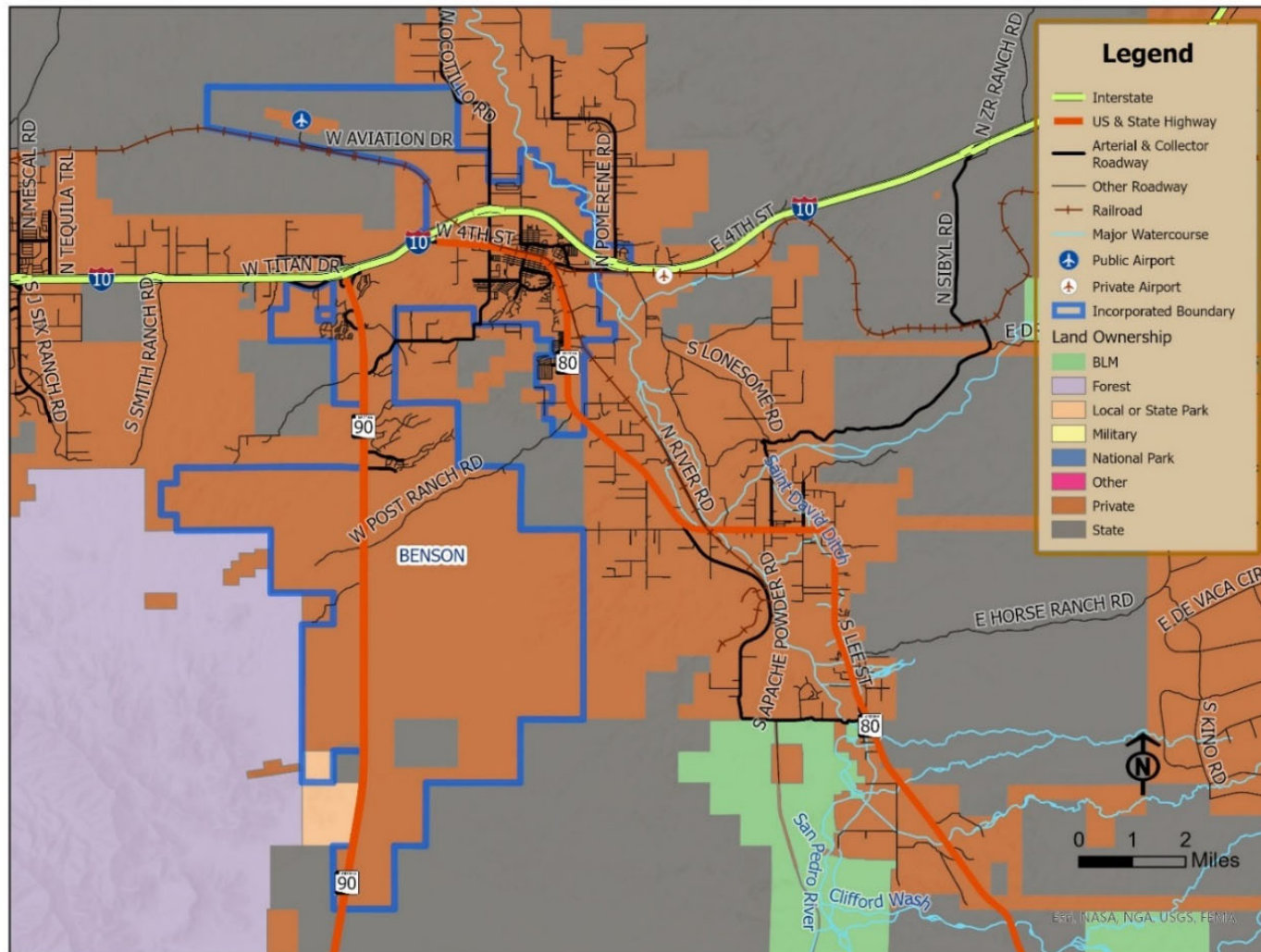
<sup>2</sup> City of Benson. (2015). *General Development Plan*. Retrieved November 3, 2022, from [https://www.cityofbenson.com/index.asp?Type=B\\_BASIC&SEC=%7BDC824B2E-E8CC-48D8-AB14-374E81D1FCB1%7D](https://www.cityofbenson.com/index.asp?Type=B_BASIC&SEC=%7BDC824B2E-E8CC-48D8-AB14-374E81D1FCB1%7D)



- 1950's – Construction of Interstate 10 and connection to State Routes 80 and 90 re-establish Benson as a significant "hub" of transportation.

Benson has identified several key growth areas in the General Plan. The Canyons at Whetstone Ranch, Cottonwood Bluffs, and Kartchner Vistas are residential communities building out along the southern portion of Benson along State Route 90. The residential communities of The Villages of Vegneto, Horizons, and an expansion of Legends R.V. community are in development. Jointly, the full development of these areas could potentially add well over 28,000 dwelling units to the City's residential stock over 20 years. These major growth areas are designed to include a mix of land uses, including commercial employment and institutional and recreational facilities, allowing the planned neighborhoods to become largely self-sufficient for day-to-day activities. The Western Gateway area, just south of Interstate 10 and west of State Route 90, consists of approximately nine square miles of uncommitted lands that could be developed by extensions of the City's infrastructure

Figure 3-4. Land Ownership and Community Location Map for Benson



### 3.3.2 *Bisbee*

Bisbee is located in southern Cochise County, approximately four miles north of the international border. The City, which serves as the county seat, is nestled into the foothills of the Mule Mountains at an elevation of 5,300 feet. According to the City's website (City of Bisbee, 2022), Bisbee serves as a well-known artist's community, with the local architectural and historic heritage well preserved. The Bisbee city limits are generally divided into three developed areas (Old Bisbee, Warren, and San Jose) that are somewhat isolated from each other and jointly occupy approximately 5.0 square miles.

The heart of Bisbee is generally located at a longitude of 109.89 degrees west and a latitude of 31.42 degrees north. Major roadway transportation routes through or near the City include State Routes 80 and 92. A spur of the Union Pacific Railroad (UPRR), now abandoned and decommissioned, once extended north from the main line tracks into the City's Warren and San Jose areas. Bisbee is also serviced by the Bisbee Municipal Airport, located south of the City limits along Arizona Street. Figure 3-5 shows all the land ownership, major roadway transportation routes, and airports within the vicinity of Bisbee.

The city is primarily drained by small to medium-sized ephemeral washes that vary in character and geometry with each area of the city. In Old Bisbee, Mule Gulch and Brewery Gulch are the primary watercourses. In the late 1890s and early 1900s, rapid growth into the canyons formed by these two watercourses situated much of the town directly in the floodplain. Culverts and other underground drainage structures were constructed to address the flooding and are still functioning today. In other areas, the washes have substantially remained in a natural condition.

Old Bisbee was the site of the original mining camp, and most buildings started up Tombstone Canyon and Brewery Gulch. Then, these progressed up the steep Mule Mountain slopes in the late 1800s. Retaining walls, stair networks, and narrow winding roads are characteristic of this area.

Development in the Old Bisbee area follows the form of the land giving the area a distinct character. However, this did not free the turn-of-the-century population from the hazards of rapidly flowing runoff from the steep rock inclines of the mountains or the problem of severe fires. Watercourses consisting of sub-level ditches have long been in place to alleviate flooding. Fires and wildfires still pose a severe threat in the town and the uplands around Bisbee. There are no regional watercourses in the vicinity of Bisbee.

Development is tightly packed, covers the mountainsides, and will most likely continue to do so as infill takes place on vacant lots. The terrain is rocky, and many sewer and gas lines are above the ground.

Drainage flows from the mountains down the Mule Gulch adjacent to Tombstone Canyon and Main Street in Old Bisbee. There is also drainage from the east of Old Bisbee down Zacatecas Canyon and Brewery Gulch, intercepting the Mule Gulch drainage way near Goar Park and Lyric Plaza.

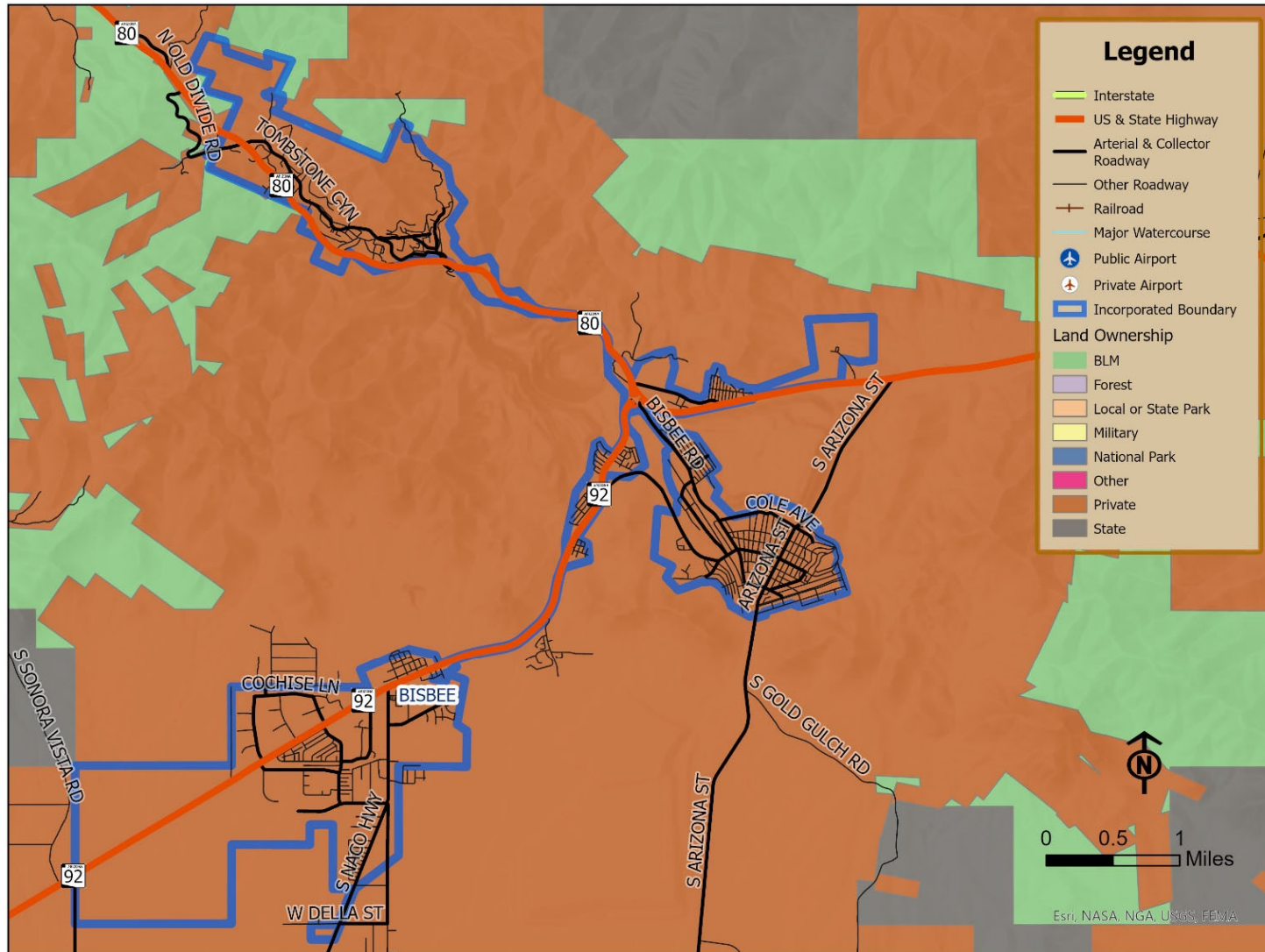
The following Bisbee development history is from the City's General Plan Update. "By the early 1900s, Bisbee was the largest city between St. Louis and San Francisco," according to the City's General Plan. The City was incorporated in 1902. A fire burned through the town in 1908, but it was largely rebuilt by 1910, and many of these historic buildings remain today. The town was built around and on mining claims throughout the Mule Mountains, where three million ounces of gold and eight billion pounds of copper have been removed. The area has also been mined for silver,

lead, and zinc. The Cochise County seat was relocated to Tombstone from Bisbee in 1929. Mining operations have slowed or completely halted on most claims since the 1970s.<sup>3</sup>

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<sup>3</sup> The Planning Center. (2015). *City of Bisbee General Plan Update*. The Bisbee Planning and Zoning Commission. Retrieved November 4, 2022, from [https://www.bisbeeaz.gov/DocumentCenter/View/233/General-Plan-Volume-I -Data-and-Analysis-Updated-June-2014-PDF?bidId=](https://www.bisbeeaz.gov/DocumentCenter/View/233/General-Plan-Volume-I--Data-and-Analysis-Updated-June-2014-PDF?bidId=)

Figure 3-5. Land Ownership and Community Location Map for Bisbee





### 3.3.3 Douglas

Douglas is located in southern Cochise County and is primarily situated on the international border, across from Agua Prieta, Sonora, Mexico. A small, isolated portion of Douglas (approximately 0.4 square miles) is located north of the central city near the Bisbee-Douglas International Airport. The main part of the city, at an elevation of 3,990 feet, lies within the Sulphur Springs Valley. Douglas is also strategically located at the Janos Highway's beginning, providing the shortest paved route from the Western U.S. to Mexico City and Guadalajara. The current city limits occupy approximately 8.8 square miles. The heart of Douglas is generally located at 109.54 degrees west and latitude 31.35 degrees north. Major transportation routes through or near the City include U.S. Highway 191 and State Route 80. Douglas is also serviced by the Douglas Municipal Airport, located on the city's east side, and the Bisbee-Douglas International Airport, located north of Douglas off U.S. Highway 191. Figure 3-6 shows land ownership, all the major roadway and railway transportation routes, and the airports within the vicinity of Douglas.

The City is primarily drained by small to medium-sized ephemeral washes that drain the Sulphur Springs Valley. All washes ultimately discharge to Whitewater Draw, the largest watercourse in the area and located just west of the city limits.

Douglas has identified four growth areas for the city, which are identified and described in its General Plan<sup>4</sup>, including City Core (Central Business District), Mid-City, Evolving Edge, and Future City.

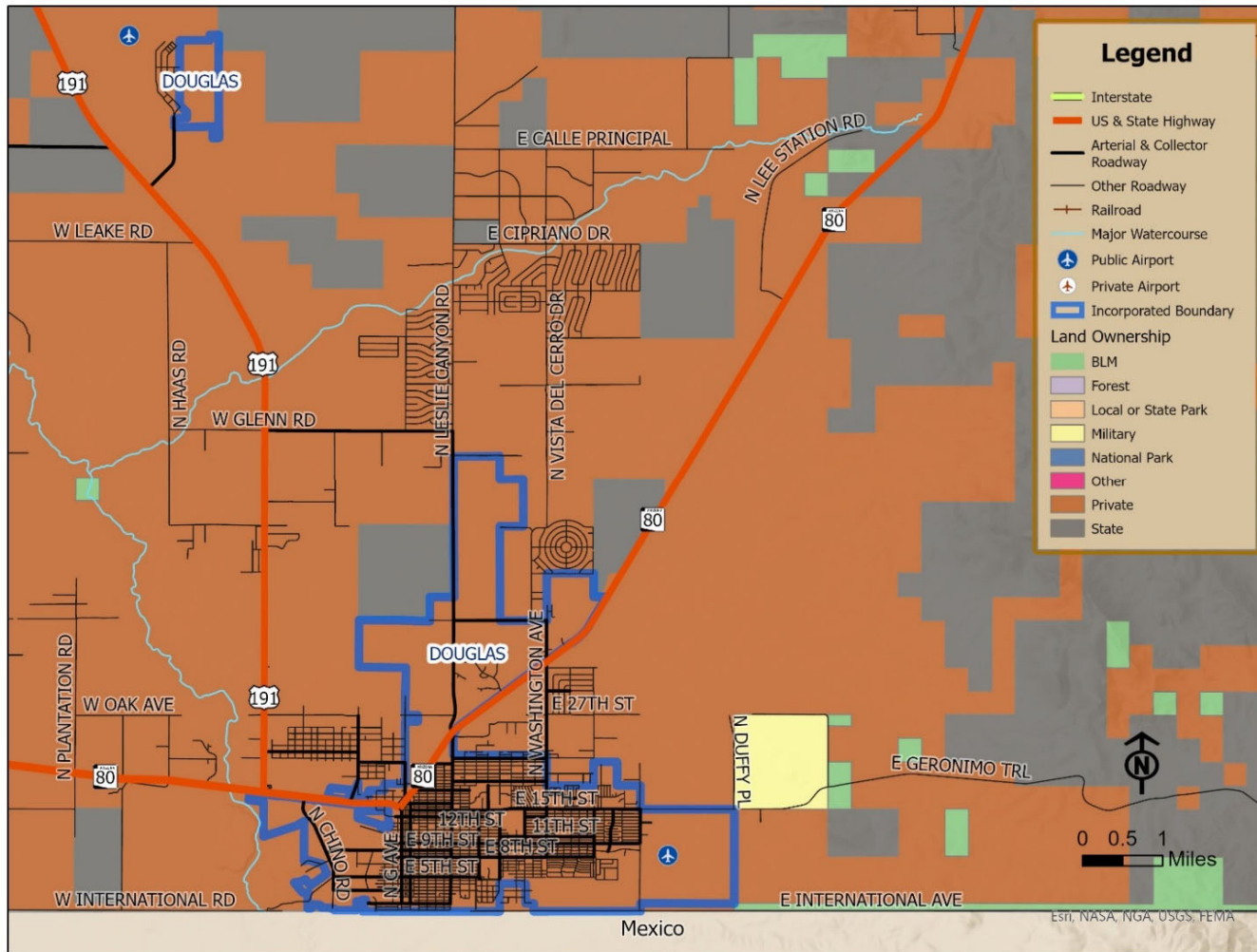
The City of Douglas and its stakeholder partners, including the Douglas Regional Economic Development Corporation, Douglas International Port Authority, Douglas Industrial Development Authority, and Cochise County, are working to improve the border crossing experience at Douglas for both goods and people. Over the past 18 months, efforts have focused on a Two-Port Solution (City of Douglas) that relocates commercial traffic to a new state-of-the-art facility and dedicates the existing port to non-commercial operations and pedestrian, car, and bus traffic.

In November 2021, Congress passed the Bipartisan Infrastructure Law, which included funding for the Douglas Two-Port Solution. The secured funding will allocate \$260 million toward constructing a new commercial port of entry four miles west of city limits and \$184 million to renovate and expand the existing Raul Castro Port of Entry.

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<sup>4</sup> The Planning Center. (2003). *City of Douglas General Plan Update*. Provided by City of Douglas.

Figure 3-6. Land Ownership and Community Location Map for Douglas



### 3.3.4 *Huachuca City*

Huachuca City, also known as the Sunset City, is located in central-western Cochise County and is approximately a 65-mile drive southeast of Tucson, Arizona. The town is situated at an average elevation of 4,320 feet and shares a southern and eastern border with the Fort Huachuca Military Reservation and Sierra Vista city limits. The San Ignacio del Babocomari Land Grant borders the Town on the north. The Huachuca and Whetstone Mountains can be viewed south and northwest of the town. The current town limits occupy approximately 2.7 square miles.

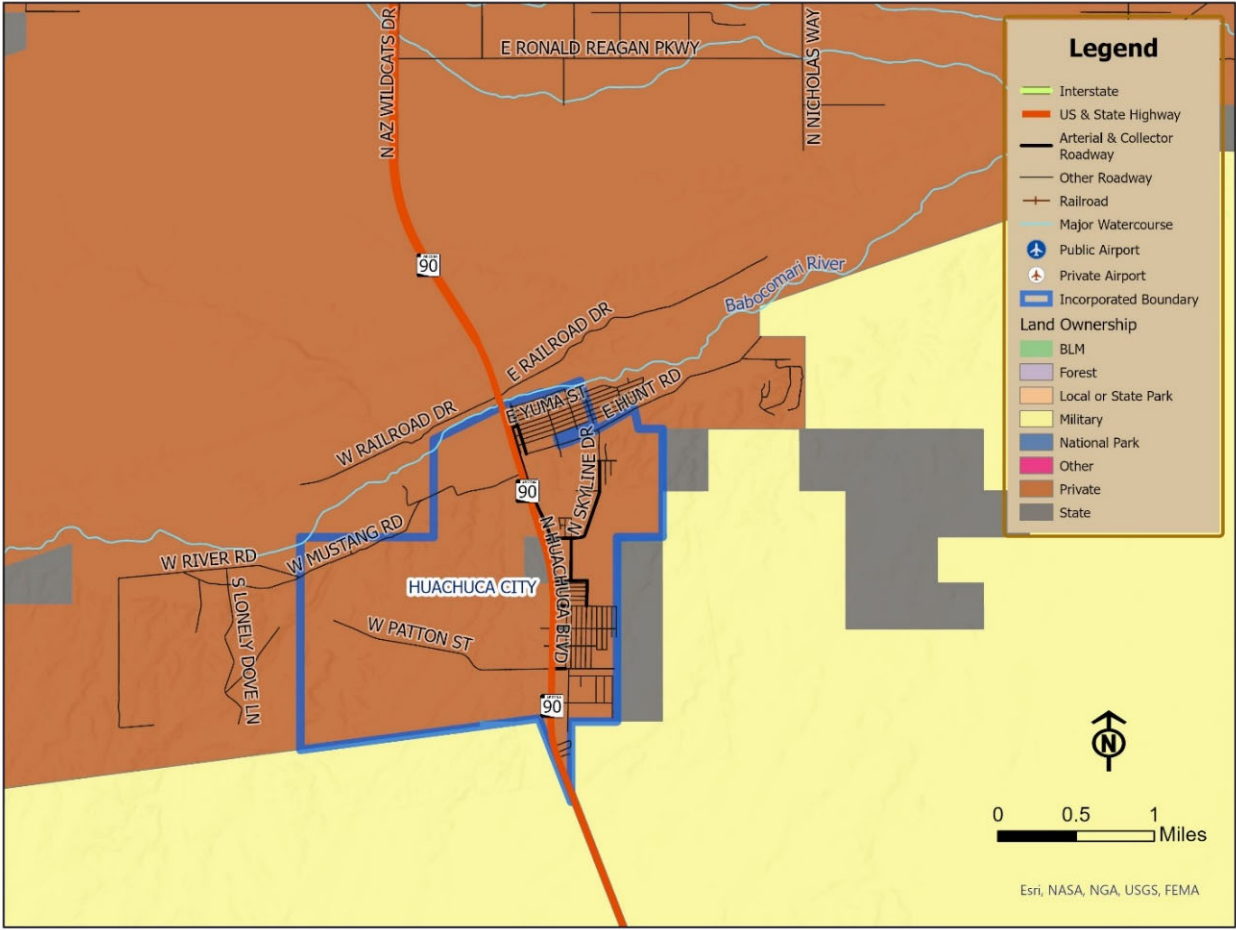
The heart of Huachuca City is generally located at 110.33 degrees west and latitude 31.63 degrees north. State Route 90 is the only major transportation route through the Town, with State Route 82 located approximately four miles north. An abandoned line of the Union Pacific Railroad (UPRR) passes just north of the town, running east-west along the Babocomari River. Huachuca City is also serviced by the Sierra Vista Municipal Airport/Libby Army Airfield, located within Fort Huachuca south of the town. Figure 3-7 shows land ownership, all the major roadway and railway transportation routes, and the airports within the vicinity of Huachuca City.

The town is primarily drained by small to medium-sized ephemeral washes that ultimately discharge to the Babocomari River on the north side of the Town. Huachuca Canyon and Slaughterhouse Wash are the largest ephemeral washes.

Huachuca City began to develop with the reopening of Fort Huachuca in 1954 and was initially established as a stop on the now-abandoned Southern Pacific Railroad. The town was then known as Huachuca Vista. The town was incorporated in 1958 under Huachuca City and has experienced minor to moderate growth since then.

Future growth of Huachuca City is limited on the north, east, and south by either Fort Huachuca/Sierra Vista or the San Ignacio del Babocomari Land Grant. The most likely future growth areas will be the portion of the town situated west of State Route 90 and the infill of currently developed areas of the city. Further descriptions of future land planning for the Town are provided in the Town's General Plan (Huachuca City, 2017).

Figure 3-7. Land Ownership and Community Location Map for Huachuca City



### 3.3.5 *Sierra Vista*

Sierra Vista is located in central-western Cochise County and is the major population center of Southeastern Arizona. The city is located approximately 70 driving miles southeast of Tucson, Arizona. Cochise County is located at the extreme southeastern corner of the State of Arizona and shares boundaries with the State of New Mexico on the east and Mexico on the south. The City is situated at an average elevation of 4,620 feet and shares a northern border with Huachuca City. The Fort Huachuca Military Reservation is part of the incorporated limits of Sierra Vista. The city's name is Spanish for "Mountain View," which accurately describes the picturesque views offered by the nearby Huachuca and Whetstone Mountains located south and northwest of the city. The city limits occupy approximately 151.3 square miles, of which 124 square miles is Fort Huachuca.

The heart of the civilian portion of Sierra Vista is generally located at 110.30 degrees west and latitude 31.56 degrees north. Major transportation routes through or near the City include State Routes 90 and 92. An abandoned Union Pacific Railroad (UPRR) line runs east-west, approximately five miles north of the city. Sierra Vista is also serviced by the Sierra Vista Municipal Airport/Libby Army Airfield, located within Fort Huachuca. Figure 3-8 shows all the major roadway and railway transportation routes and the airports within the vicinity of Sierra Vista.

The city is primarily drained by small to medium-sized ephemeral washes that vary in character and geometry with each area of the city. All of the washes convey runoff from the Huachuca Mountains piedmont areas to the San Pedro River, located approximately two miles east of the city.

The majority of land within the City is Fort Huachuca Military Reservation. The remaining area is divided between private ownership and Arizona State Land. Figure 3-8 visually depicts the land ownership in and around Sierra Vista.

The Vista General Plan 2030 also provides a wealth of information summarizing the economic and demographic characteristics of Sierra Vista. According to the General Plan<sup>5</sup>:

"The history of Sierra Vista began with the establishment of Camp Huachuca in 1877. Over the years the military outpost became a Fort and served as the home of the famed Buffalo Soldiers of the 9th and 10th Cavalry. During World War II the mission of the Fort changed to an infantry training base. After the war, the Fort closed for a number of years and then reopened in 1954. Shortly thereafter, the community, which had been developing to the east of the Fort, incorporated as Sierra Vista. Several major commands, including the U.S. Army's Network Enterprise Technology Command, Intelligence Center and School, and Electronic Proving Grounds currently operate on Fort Huachuca."

Sierra Vista has identified four primary growth areas in the General Plan:

- State Trust Land, Section 2
- State Trust Land, Section 36
- Land currently owned by Castle and Cooke Arizona, Inc.

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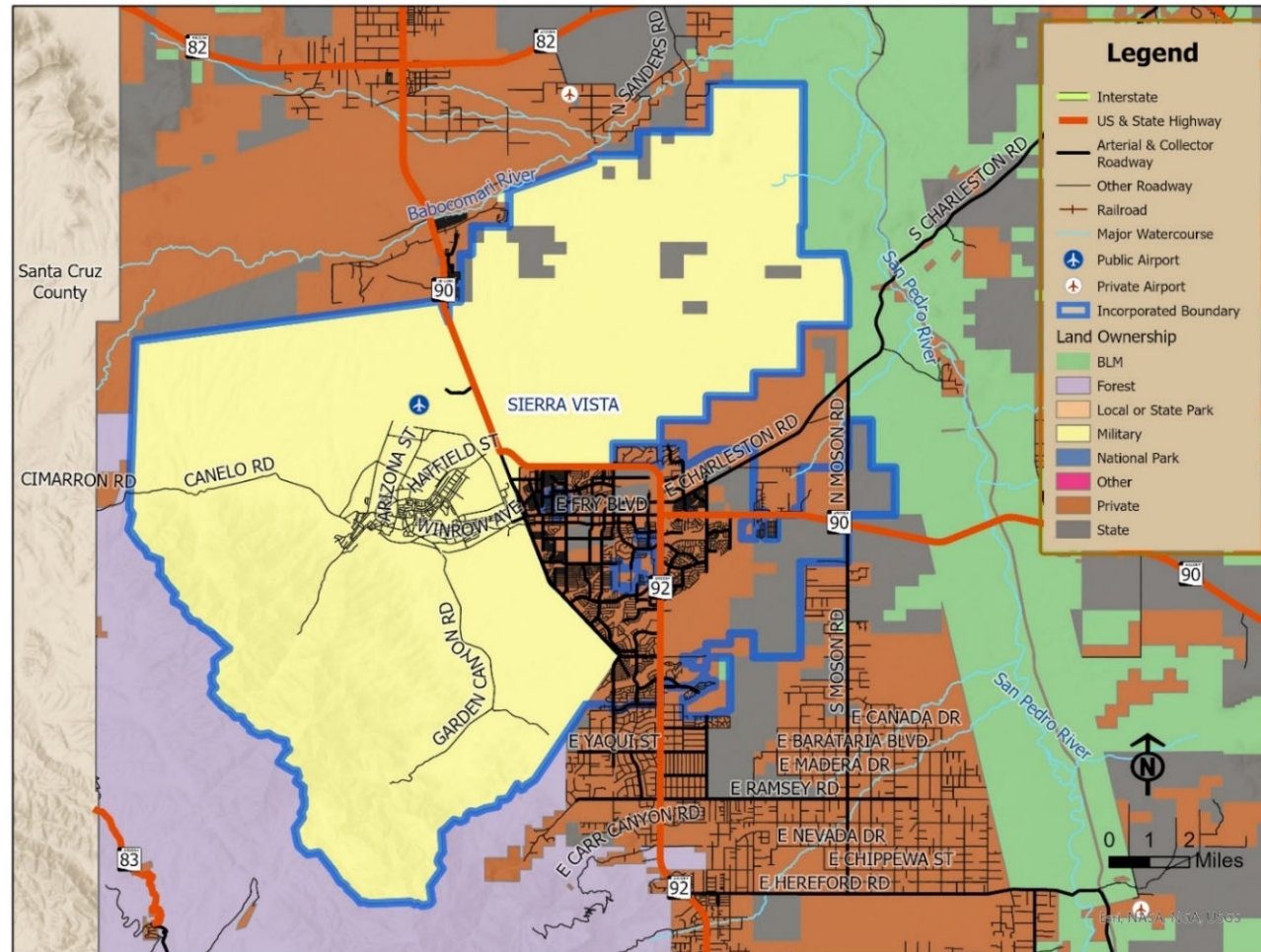
<sup>5</sup> City of Sierra Vista. (2014). Vista 2030 General Plan. Retrieved November 3, 2022, from <https://www.sierravistaaz.gov/our-city/departments/community-development/vista-2030>

- Land presently owned by Bella Vista Ranches.

Section 2 includes 240 acres of undeveloped State Trust Land. The City has already invested in infrastructure in this section, including Wilcox and Coronado Drives and a main sewer line. Additionally, the City's Transit Center is located in this section. The current plan shows a mix of land use and multiple zoning designations. Section 36 includes 320 acres of mostly undeveloped State Trust Land. Again, the City has already invested in infrastructure within this section. The current plan shows a mix of land use and multiple zoning designations. Sections 2 and 36 are both prime locations for future development. Because of the location of the sections, growth in these areas could help reduce sprawl. Additionally, because infrastructure is already in place, there will be reduced public improvement costs.

There are two large, privately owned land holdings in the City. The landowners, Castle & Cooke Arizona, Inc., and Bella Vista Ranches, have adopted land use plans that designate a mixture of residential, open space, commercial, and industrial uses.

Figure 3-8. Land Ownership and Community Location Map for Sierra Vista



### 3.3.6 Tombstone

Tombstone is located within the San Pedro Valley of Cochise County, Arizona, at 4,540 feet elevation. The City of Tombstone is known as Arizona's oldest mining camp and probably the most famous mining town in America. Once a mining boomtown, it traces its beginnings to 1877 when Ed Schieffelin, a prospector, left Ft. Huachuca to seek his fortune despite the fierce Apache that roamed the area. Ed Schieffelin found his first claim and named it "Tombstone" and later named his second claim "Graveyard." Tombstone's city limits currently occupy approximately 4.21 square miles. The business district is located north and east of the historic district. The mining district occupies over nine square miles of silver and gold mines within and outside the city limits. During the mining of 1879 through 1934, the production value of minerals in this area included 81% silver and 14% gold.

The heart of Tombstone is located at 110.06 degrees west and latitude 31. 71 degrees north. Major transportation routes through or near Tombstone include Interstate 10 and State Routes 80 and 82. State Route 80, which is locally known as Freemont Street, serves as Tombstone's "Main Street" and connects Tombstone to Benson (19 miles to the northwest) and passes through St. David. Tombstone Municipal Airport services Tombstone. Figure 3-9 shows all the major roadways, transportation routes, and airports within the vicinity of Tombstone. Walnut Gulch is the only significant watercourse flowing through the undeveloped northeastern portion within the Tombstone's boundaries.

During the winter, the population can increase to 2,000 people from other parts of the country, seeking a more moderate climate. Throughout the year, Tombstone experiences 2.5 million visitors coming to participate in the Town's history of the old west, celebrations, and events. Tombstone's location along Interstate 10 and State Route 80 trade routes and its historical significance as a Registered Historical Landmark support a strong tourism industry and retirement community that employs approximately 51% of the workforce. Some of Tombstone's historic buildings include the Courthouse built in 1882, which is now a state park; the Rose Tree Museum; three churches; the Bird Cage Theatre; the Crystal Palace Saloon; and Big Nose Kate's Saloon. Daily re-enactments of the Town's past include stagecoach tours, shoot-outs, and the Helldorado Celebration held during October.

Prominent land-holders within Tombstone are divided between private land holdings, State Land, and the Bureau of Land Management. Figure 3-9 visually depicts the land ownership in Tombstone. Tombstone also serves as a bedroom community for Tucson and Sierra Vista.

According to the Chamber of Commerce, Tombstone's history began in 1877 when a mining prospector named Ed Schieffelin discovered silver in this wild frontier. As news of the rich strike spread, people came from all over to seek their fortune. Huge fortunes were being made by both legitimate businesses and unlawful individuals, including thieves, gamblers, cattle rustlers, gunmen, saloons, and bordellos. The city was incorporated in 1881 and continued to grow rapidly until 1911 when the boomtown ended. After surviving the Great Depression and the removal of the County Seat to Bisbee in the 1930s, Tombstone became known as the "Town Too Tough To Die."

The City of Tombstone's development has been limited, with the latest annexation on record occurring with Tombstone Territorial Estates in the late 1970s. Based on surveys from Tombstone's

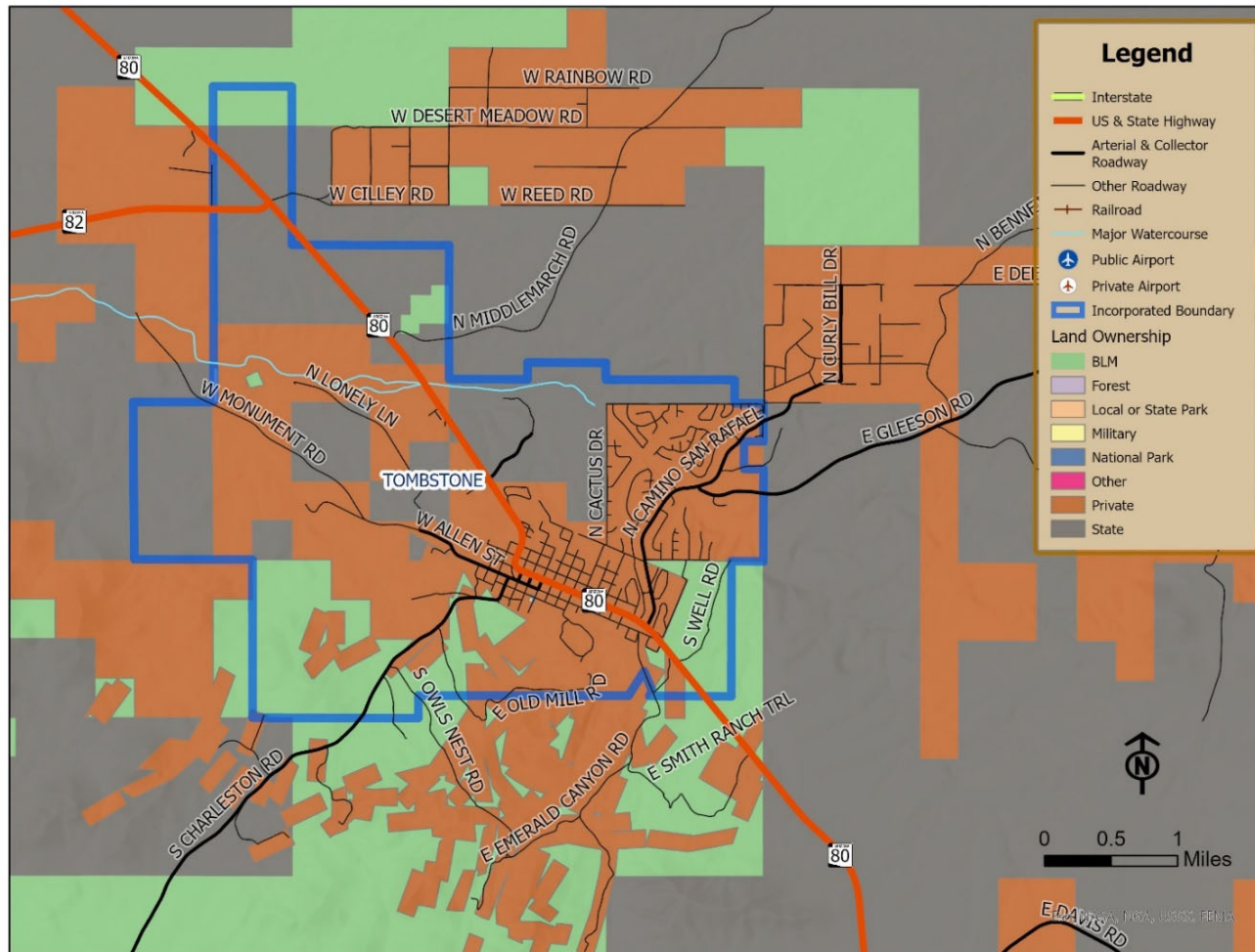


citizens, as stated in the Master Plan<sup>6</sup>, the overall theme desired by the community is to improve existing City services and provide essential goods and services such as a grocery store, medical clinic, fast food restaurants and encourage light industry. Figure 3-9. Land Ownership and Community Location Map for Tombstone

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<sup>6</sup> City of Tombstone. (n.d.). Retrieved 2017, from <https://cityoftombstoneaz.gov/planning-zoning/>

Figure 3-9. Land Ownership and Community Location Map for Tombstone



### 3.3.7 Willcox

Willcox is located in north-central Cochise County at an elevation of 4,167 feet. Lying on the northern drainages descending from the Pinaleno Mountains into the endorheic basin, the Sulphur Springs Valley is known as the Willcox Playa.

Founded in 1880 with the arrival of the Southern Pacific Railroad, the City of Willcox was incorporated in 1915, just two years after Arizona became a State. With its roots deep in railroad traditions and agriculture as its mainstay, Willcox has grown in population and land mass (incorporated and unincorporated areas) and adapted from trains to trucks, serving as a major transportation hub along one of the busiest interstate highways, Interstate 10, in the United States just 80 miles north of the U.S. and Mexico border. Willcox continues to serve as the trade center for the northern portion of Cochise County.

Willcox was in the middle of the hustle and bustle of the old west. With the railroad going through the center of town, it was an ideal location for the shipment of cattle and any goods produced in the area that were shipped throughout the United States. Incoming trains brought goods needed in the county's northern part. Fort Bowie and the local mining community of Dos Cabezas had many supplies come in via the railroad.

Roadway transportation routes through or near the City include Interstate 10, U.S. Highway 191, and State Route 186. The Union Pacific Railroad (UPRR) passes through the City, with the east-west line generally paralleling the Interstate 10 alignment and a line extending south. Willcox is serviced by the public Cochise County Airport and two private airstrips. Figure 3-16 shows all the major railways, roadways, and airports within the vicinity of Willcox.

Due to the playa topography, significant precipitation events in the mountains north of Willcox will flow through the city. Due to the relatively flat terrain, there are no major natural riverine watercourses within the City. Instead, the drainage through the area is characterized by broad and shallow sheet flooding, ponding, and small, local, artificial drainage ditches and channels.

Willcox can easily be defined by its development history, specifically rapid growth followed by years of economic stagnation. Without new development, a growing tax base, or the need to modernize systems, the city faced increasing frustration as infrastructure initially developed in the 1930s fell into disrepair. Once a thriving community with viable services. Unlike the wildcat subdivisions in many communities, Willcox had a well-thought-out gridded system and service delivery for water and natural gas and retrieval systems in place for water and waste. After its heyday, Willcox experienced long periods of economic stagnation when the now outdated and deteriorating infrastructure became obsolete, serving far beyond its useful life.

The earliest census (1880) counted 396 individuals. By 1980 the population had soared to 3,500. It then stagnated with population fluctuations during the following four decennial surveys and a - 5.4% growth rate over the last decade, while Arizona's population saw an increase of 14% during the 2010s. While other Arizona cities and towns grew, developed new neighborhoods, and slowly replaced early amenities, Willcox could not keep up. spurts of growth followed the boom in the early part of the last century, followed by a slow decline in people and resources. This put the community, especially lower-income neighborhoods, in a bad position.

The American Community Survey quantifies this phenomenon over the past 50 years, reporting the population of Willcox has fluctuated between 2,570 residents to 3,757 residents, with a density

of 560 persons per square mile. Between 2011-2019 the population low reached 3,505 in 2017, with a high of 3,768 in 2011.

Willcox is known for extraordinary migratory bird viewing opportunities with the presence of the riparian lake system in the southern extent of the city. Willcox is about halfway between Phoenix, Arizona and El Paso, Texas on Interstate 10, about 80 miles east of Tucson. The Willcox city limits currently occupy approximately 6.5 square miles.

Willcox families have struggled with median incomes far below and poverty rates above other residents in the county, state, and surrounding communities over the years. With a median household income of \$36,756 more than \$10, 000 short of Bisbee's, \$13,000 below Cochise County's, and a staggering \$15,000 under the neighboring communities of Thatcher, Sierra Vista, and Safford, residents struggle to keep up with day-to-day expenses. The City's poverty is not a new phenomenon. Alongside negative growth comes economic hardship. A median household income half or less than the United States overall is an alarming trend for the entire community and hardest felt by the residents of the colonias trying to manage the cost of maintaining aging housing with higher utility costs. Using data gleaned from historical records and documentation of systems that began to be produced and saved in the middle of the 20th century, it is clear that in 1990 Willcox fell well within the criteria for Colonia status. In fact, during the prior two decades, the community needed many basic services, including safe portable water, adequate sewer, and good-quality housing.

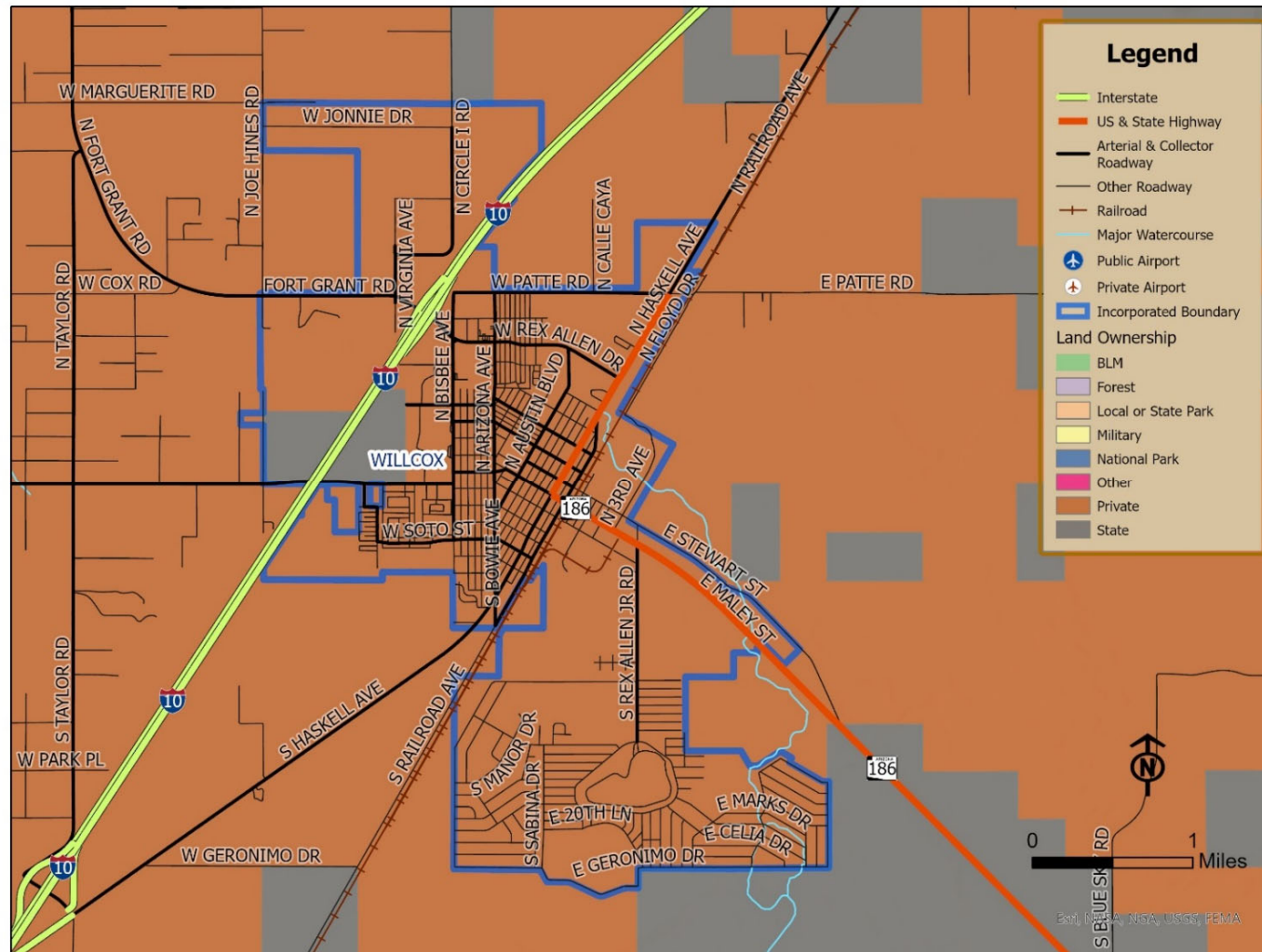
Land within Willcox is primarily owned by private entities with approximately 200 acres in State Trust Land. Figure 3-10 visually depicts the land ownership in Willcox. The City of Willcox General Plan 2040 provides a wealth of information summarizing Willcox's economic and demographic characteristics<sup>7</sup>. Development areas and projects in Willcox include:

- Downtown – Revitalization of downtown areas that can build upon the historical, tourist-attracting resources through the construction of infill housing and developing a shuttle service and pedestrian pathways to enable visitors to enjoy the flavor of the Old West with shopping, museums, food/fun establishments, and civic events. With municipal services in place, downtown Willcox is convenient to schools, churches, recreation, and jobs, all within walking distance.
- 340 Interchange – Modernizing this interchange will facilitate commercial expansion by creating smoother traffic movements (especially for interstate trucks), reducing congestion, and opening prime frontages to vehicular access. Existing convenience and local shopping needs will grow concentrically with internal circulation driveways and proper floodwater diversion. These improvements will also accommodate the development of hotels, restaurants, trucker services, etc., and the direct access to Interstate 10 may also inspire apartment development for commuters who use the Interstate.
- Cochise Lake Neighborhood – The original master plan for this area could be revived or redesigned to develop various housing types and prices that would appeal to a broader range of prospective homeowners. The neighborhood enjoys many outdoor living amenities such as golfing on the existing nine-hole municipal course, bicycling and walking trails, bird-watching, picnicking, and parks.

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<sup>7</sup> Willcox, C. o. (n.d.). *City of Willcox 2040 General Plan*. Retrieved November 4, 2022, from <https://willcox.az.gov/media/Planning%20and%20Zoning%20Commission/2040%20General%20Plan.pdf>

Figure 3-10. Land Ownership and Community Location Map for Willcox



## **SECTION 4: PLANNING PROCESS**

This section includes the delineation of various DMA 2000 regulatory requirements, as well as the identification of key stakeholders and planning team members within Cochise County. In addition, the necessary public involvement meetings and actions that were applied to this process are also detailed.

### **4.1 Planning Process Description**

Cochise County applied for and received a PDM planning grant through the Arizona Division of Emergency Management (ADEM) to fund a multi-jurisdictional effort to review and update the 2017 Plan. The county selected BearPAL Consulting, LLC, to work with the participating jurisdictions and guide the planning process. The initial project scope and kickoff meeting between the County, DEMA, and the consultant occurred in early March 2022. An agreement was signed between the County and State contacts for support throughout the project.

A total of eight Planning Team meetings were conducted from April through October 2022. Two of these meetings were held in person with remote available, and the rest were held remotely. Throughout the planning period from April through October, the work to collect, process, and document updated data, make changes to the Plan and prepare the draft of the Plan was performed. Details regarding key contact information and promulgation authorities, the planning team selection, participation and activities, and public involvement are discussed in the following sections.

### **4.2 Previous Planning Process Assessment**

The first preparation task for this Plan revision was to evaluate the process used to develop the 2017 Plan. Unfortunately, any documentation from the prior consultant was unavailable for use. The planning team format remains the same as the preceding revision with a multi-jurisdictional, whole-community approach. A single planning team comprised of representatives from all participating jurisdictions and entities, including local, state, and federal agencies and organizations, was gathered based on current contacts and past participants.

### **4.3 Primary Point of Contact**

Table 4-1 summarizes the points of contact identified for each participating jurisdiction in the planning process. Those in bold were involved in the 2017 planning process.

Table 4-1. List of Adopting Jurisdictional Points of Contact		
Jurisdiction	Primary Contact	Additional Jurisdictional Representatives/Team Members
Cochise County	Tammi-Jo Wilkens	Dan Duchon, Jackie Watkins, Joaquin Solis, Terry Cochenour, Jane Montgomery, Jason Faccio, Marty Haverty, Dan Coxworth
City of Benson	<b>Kieth Spangler</b>	<b>Brad Hamilton</b> , Greg Volker, Al Carruthers, Michelle Johnson
City of Bisbee	Matthew Gurney	Danielle Bouchever, Logan Dodd, Jim Richardson, Tim Cox, Lorena Valdez, Joe Ward
City of Douglas	<b>Kraig Fullen</b>	Luis Pedroza, Oscar Elias, Rene Molina, William Osborne, Max Tapia, Elise Moore
Town of Huachuca City	Suzanne Harvey	Jim Halterman, <b>Jim Thies</b> , Dr. Jim Johnson, Mark Savage
City of Sierra Vista	<b>Sharon Flissar</b>	Matt McLachlan, Adam Thrasher, Brian Jones
City of Tombstone	Elke Remeikis	Jim Adams, Josh Dutcher
City of Willcox	Jeff Stoddard	Theresa VanHook, Dale Hadfield, Yasmin Cuevas-Avalos

#### 4.4 Planning Team

The role of the Planning Team was to work with the county and planning consultant to perform the coordination, research, and planning element activities required to update the 2017 Plan. Attendance by each participating jurisdiction was strongly encouraged for every Planning Team meeting, and the meetings were structured to progress through the planning process. Steps and procedures for updating the 2017 Plan were presented, and the planning process steps and assignments were discussed. The process was broken down into several Milestones, including Planning, Hazard and Risk Review, Mitigation Actions, and Plan Revision/Adoption. Each meeting built on information from prior meetings and discussions. In addition to Milestone meetings, several meetings were held between crucial Milestone Meetings to keep the process moving.

It was stressed during the planning process that these primary jurisdictional points of contact needed to help serve as the liaison between the Planning Team and the local jurisdictional teams for assignment completion. The Planning Team understood this role would include the following:

- Conveying information and assignments received at the Planning Team meetings to their jurisdictions.
- Engaging local leadership and staff to ensure a collective community voice as assignments and information were requested.
- Soliciting jurisdiction-wide input as decisions were made and draft documents were prepared for review.
- Ensuring that all requested assignments were completed fully and returned promptly.
- Arranging for review and official adoption of the Plan.

##### 4.4.1 Planning Team Assembly

At the beginning of the planning process, Cochise County organized and identified members for the Planning Team by contacting and extending invitations to all incorporated communities within the county limits and other agency and organizational contacts. The county, local jurisdictions, and consultant expanded this list as the planning proceeded. The main points of contact for the jurisdictional planning teams are in Table 4-1 above. Other participating members of the Planning

Team that were invited to participate, attended meetings, or contributed during the planning process are summarized in Table 4-2. Other entities participating are also listed in Section 4.4.3.

Table 4-2: Additional Planning Team Members/Invitees	
Name	Jurisdiction / Organization
Alexandria Maese	Arizona Department of Emergency and Military Affairs
Lucrecia Hernandez	Arizona Department of Emergency and Military Affairs
Ronald Gonsalves	Arizona Department of Emergency and Military Affairs
Morgana Laurie	Arizona Department of Emergency and Military Affairs
Erinanne Saffell	Arizona State University
Josh Henson	Arizona Department of Public Safety
Michael Conway	Arizona Geological Survey
Ken Drozd	National Weather Service
Matthew Pace	Arizona Department of Environmental Quality
Mike Shelton	Arizona Department of Water Resources
Stuart Rodeffer	Arizona Department of Forestry and Fire Management
Brianna Rooney	Arizona Hospital and Healthcare Association
David Prince	Fort Huachuca Army Base
Richard Waters	Fort Huachuca Army Base

#### 4.4.2 Planning Team Activities

The Planning Team activities are documented below. Agendas for these meetings are included in Appendix B. Each meeting was recorded and sent out with assignments for members who could not attend. Following each Planning Team meeting, the Point of Contact for each jurisdiction were encouraged to convene meetings with their local jurisdictional leadership and staff, as needed, to work through the assignments.

The Planning Team utilized Microsoft Teams software for collaboration between team members, including document sharing, meetings, recordings, maps, and project tracking information. Cochise County Information Technology maintained this site.

##### *Initial Planning Team Kick-Off Meeting – 4/5/2022*

Invites were sent out to former team members and known planning contacts. The consultant led the online meeting and reviewed the overall planning process and the timeline for the 2022 revision. The meeting focused on defining mitigation, purpose and benefits, proposed project approach and schedule, jurisdictional participation requirements, hazard discussions, a five-year plan review, requests for data/studies/information, and public outreach efforts. The team was



asked to identify Jurisdictional Planning Team contacts and provide them to the County and consultant.

#### *Milestone Meeting #1 – Planning and Community Descriptions – 5/11/2022*

The invitees included the Initial Planning Team contacts and additional jurisdictional contacts. The consultant led the online meeting focusing on the first assignment to update the community descriptions and past and future public and stakeholder participation efforts by the jurisdictions and County. The progress timeline was reviewed, questions answered, and assignments were sent after the meeting. The meeting was recorded and available on the Microsoft Teams project site.

#### *Milestone Meeting #2 – Hazards and Risks – 6/6/2022*

The Planning Team and other contributors were invited to review the 2017 Plan's hazards and risks. The consultant presented each hazard with a review of the FEMA National Risk Index and any new information sources on the risks. The Team decided to stay with the same risks as the 2017 plan. The Calculated Priority Risk Index (CPRI) rating system was reviewed, and the Team agreed to use the system again, with the jurisdiction completing their CPRIs rather than using the prior consultant's survey format. The assignments for the second milestone included having each jurisdiction review its history with the hazard, assess its CPRIs, and complete its vulnerability updates. As with the other meetings, an overview of the current status and activities was reviewed along with the ongoing timeline. The meeting was shared via Microsoft Teams, and Assignments were shared with the jurisdictional team leads. Agency and organizational contacts with information for each hazard were sent copies to review and provide updates and new data.

#### *Milestone #2 Follow Up In Person on Hazards and Risks – 6/27/2022*

This was one of two in-person meetings held throughout the process. The meeting was held at the Sierra Vista Police Department. Progress on previous assignments included the community descriptions and questions about the public outreach efforts. The National Risk Index and hazard and risk update assignment were covered for each hazard. The team decided to maintain the current hazards in the revision. A question was received from the public through the online comment form about the addition of Hazardous Materials in the plan. The main concerns were Apache Nitrogen Products and transportation along the Interstate 10 corridor. The team decided that Hazardous Materials are covered through the Local Emergency Planning Committee, the County Emergency Operations Plan, and to some extent through the Threat and Hazard Identification and Risk Assessment (THIRA) process. In addition, it is not a natural hazard, so Hazardous Materials were not added to this revision. The CPRIs that had been turned over to the consultant were reviewed. The meeting was recorded and posted to the Microsoft Teams page.

#### *Milestone #3 Mitigation Actions Meeting – 7/25/2022*

This meeting was held online to update progress and introduce the third milestone of mitigation actions. A timeline review was completed along with missing assignments to this date. Then the third milestone was introduced, including goals and objectives, NFIP compliance, capabilities assessment, past mitigation actions updates, and future mitigation actions creation. In addition, all of the hazards from the prior assignment were distributed to the team for assistance in completing their vulnerability assessments. The meeting was recorded, and assignments were distributed to the jurisdictional representatives. The Team agreed that an in-person meeting was warranted to cover any questions on these assignments for the following month. The session was recorded and made available on the Microsoft Teams site.

#### *Milestone #3 Follow Up In Person on Mitigation Actions Meeting – 8/23/2022*

This was the second in-person meeting held at the Sierra Vista Police Department Auditorium. As usual, the meeting began with a review of the current progress. The community description, public outreach, and risk assessment progress were covered. In addition, the team discussed the addition of Dams and Dam Failures as a hazard profile based on some concerns from team members. After a discussion, the team determined that the hazards didn't fit the Dam and Dam Failure category and would be added where appropriate to other hazards in the plan, such as in Flood/Flash Flood. A review of the CPRIs to date was completed, and the priority hazards were determined to be Wildfire, Flood/Flash Flood, and Severe Wind. Drought was also close to the top three priority areas. The team discussed the overall plan goals and objectives, and some slight edits were made and agreed upon. The capabilities, NFIP, past mitigation actions, and new mitigation action assignments were covered, and questions were answered. The consultant made office hours available to assist jurisdictions in completing tasks. A review of the following steps and some questions on grant applications were responded to. The meeting was recorded and made available on the Teams site.

#### *Milestones #4 and #5 Plan Revision and Adoption Review Meeting – 10/27/2022*

This was the final Planning Team meeting held with all participants invited. All assignments were updated. The consultant requested lists of participants for each jurisdiction's local team participants. A review of the missing assignments was briefly covered in general, but the consultant notified the jurisdictions with missing assignments before the meeting. The plan review and adoption process was discussed. Each jurisdiction was asked to provide the consultant with their Q1 2023 board meetings for adoption, and the participants were directed to their prior adoption language to prepare. The County public information officer was asked to schedule another press release for public notice when the draft plan was available for review.

#### **4.4.3 Agency/Organizational Participation**

The planning process used to develop the 2022 Plan included participation from several agencies and organizations which operate within or have jurisdiction over small and large areas of Cochise County. The agencies/organizations invited to participate included:

- Arizona Department of Emergency & Military Affairs
- Fort Huachuca Army Base
- National Weather Service
- National Park Service
- U.S. Bureau of Land Management
- U.S. Forest Service
- Arizona Department of Public Safety
- Arizona Department of Corrections
- Arizona Hospital and Healthcare Association
- Arizona Red Cross
- Arizona Department of Environmental Quality
- Arizona Department of Water Resources
- Arizona State Climatologist (Arizona State University)
- Arizona Department of Forestry and Fire Management
- Arizona Geological Survey

Other organizations, such as schools, non-profits, and businesses, were also extended opportunities for participation in the planning process by using general public notices across County and Jurisdictional partner websites and social media accounts. Examples of public outreach by the County and Jurisdictions are in Appendix C.

An integral part of the planning process included coordination with agencies and organizations outside the participating jurisdiction's governance to obtain information and data for inclusion into the Plan or to provide more public exposure to the planning process. Much of the information and data used in the risk assessment is developed by agencies or organizations other than the participating jurisdictions. In some cases, the jurisdictions may be members of a larger organization that has jointly conducted a study or planning effort, like the development of a community wildfire protection plan or participation in an area association of governments. Those data sets include the FEMA floodplain mapping, community wildfire protection plans, severe weather statistics, hazard incident reports, and other customized reports. The resources obtained, reviewed, and compiled into the risk assessment are summarized at the end of this Plan Section and at the end of each subsection of Section 5.3 of this Plan. The consultant worked with state and federal representatives by personal contact with the host agency or organization, downloading the information posted and sourced, or working with County and Jurisdiction representatives to acquire the data.

#### *4.4.4 Public Involvement*

An essential component of the success of the mitigation planning process involved ongoing public, jurisdiction, and stakeholder participation. Public outreach provided the planning team with a clearer perspective of local concerns and ensured a higher degree of mitigation success by developing community feedback from those directly affected by policy decisions. A broad range of public and private stakeholders was invited to participate in the Plan revision. The public was primarily directed to planning and reference materials on the Cochise County project website. Local jurisdictions were then encouraged to develop their sites to link back to the County project page. Press releases were also created at the beginning of the project and when the revision was ready for review. A link on the main page allowed the community to comment and ask questions. The planning team chose this method rather than engaging in formal public surveys. Surveys conducted by the previous consultant in 2016 showed the public's most significant perceived risks were Flood/Flash Flood and Wildfire, and the two lowest perceived risks were Building Collapse/Mine Subsidence and Earthquake. The Planning Team felt that these sentiments still held for the current revision.

The public comment form on the project website remained open throughout the revision process. The press releases by Cochise County at the beginning and end of the planning process pushed public participation through the comment form. Comments were reviewed as received by the Planning Team and addressed in the plan if warranted. Appendix C contains the comments along with responses from the Planning Team. Interested citizens were also encouraged to participate in the local community adoption process, which may have included a public meeting and a formal public hearing depending upon the jurisdiction.

Additional public involvement tools successfully utilized as a part of this planning process include:

- Throughout the planning process, jurisdictions were asked to help inform their communities about this planning process when opportunities presented themselves.
- The County Public Information Officer (PIO) leveraged all available tools to message the public at key project milestones, utilizing Facebook, Twitter, Facebook groups, the

previously mentioned website, and emails to existing contact lists, which included: elected officials, appointed officials, local news reporters, and community leaders.

- The County Emergency Manager and Deputy Emergency Manager utilized interaction opportunities with citizens and community organizations about the revision process as they arose when meeting with community members or county and local partners.

#### 4.4.5 Reference Documents and Technical Resources

Numerous plans, studies, reports, and technical information were obtained and reviewed for incorporation or reference purposes throughout the update planning process. Most sources referenced and researched pertain to the Plan's hazard and risk assessment portion. The capabilities assessment contains numerous references to local, state, and federal plans, documents, reports, standards, regulations, and codes. To a lesser extent, the community descriptions and mitigation strategy also included some documents or technical reference information. Table 4.3 lists the primary documents and technical resources reviewed and used in the Plan. Detailed bibliographic references are provided as footnotes or sources below tables or figures. Professional insights, opinions, and information are throughout the document but may not have direct references.

Table 4-3. List of resource documents and references reviewed and incorporated in the plan update process		
Referenced Document or Technical Source	Resource Type	Description of Reference and Its Use
Federal Emergency Management Agency	Guidance Document	Local Mitigation Planning Policy Guide F.P. 206-21-0002, April 2022. Overall planning guidance.
Arizona Department of Commerce	Website Data and Community Profiles	Reference for demographic and economic data for the county. Used for community descriptions.
Arizona Department of Emergency and Military Affairs	Data and Planning Resource	Resource for state and federal disaster declaration information for Arizona. Also, a resource for hazard mitigation planning guidance and documents.
Arizona Department of Water Resources	Technical Resource	Arizona State Drought Preparedness Plan and Arizona Drought Monitor Report. Resource for data on drought conditions and statewide drought management, fissure, and dam safety data. Used in risk assessment.
Arizona Geological Survey	Technical Resource	Resource for earthquake, fissure, subsidence, and other geological hazards. Used in the risk assessment.
Arizona Department of Forestry and Fire Management	Data Source	Source for statewide GIS coverages (ALRIS) and statewide wildfire hazard profile information (Division of Forestry). Used in the risk assessment.
National Flood Insurance Program	Website Database	Source for NFIP statistics for Arizona through Floodsmart program.
Cochise County Multi-Jurisdictional Hazard Mitigation Plan (2017)	Hazard Mitigation Plan	FEMA county-wide approved hazard mitigation plan for revision and resources.
Cochise County Community Wildfire Protection Plan (2014)	CWPP	Prepared by the Bureau of Land Management (BLM) Gila District Office; the Coronado National Forest (CNF) Douglas and Sierra Vista Ranger Districts; the U.S. Fish and Wildlife Service; and the National Park Service (NPS) Chiricahua National Monument, Fort Bowie National Historic Site, and Coronado National Memorial. For use in wildfire risk assessment.
Cochise County GIS	GIS Data	Source for county-wide GIS data and additional flood hazard data sets. Used for maps and risk assessment.

Table 4-3. (cont.) List of resource documents and references reviewed and incorporated in the plan update process

Referenced Document or Technical Source	Resource Type	Description of Reference and Its Use
InciWeb - Incident Information System	Wildfire Data	Source wildfire incident information for historical hazard and profile information.
Federal Emergency Management Agency	Technical and Planning Resource	Floodplain and flooding-related NFIP data (mapping, repetitive loss, NFIP statistics) and historic hazard incidents. Used in the risk assessment and mitigation strategy sections.
FEMA National Risk Index	Technical Resource	Hazard and risk profile baseline information.
National Center for Environmental Information	Technical Resource	Online resource for weather-related data and historic hazard event data. Used in the risk assessment.
National Weather Service	Technical Resource	Source for hazard information, data sets, and historical event records. Used in the risk assessment and community descriptions.
National Wildfire Coordination Group	Technical Resource	Source for historic wildfire hazard information. Used in the risk assessment.
Office of the State Climatologist for Arizona	Website Reference Expert Review	Reference for weather characteristics for the county. Used for community descriptions and risk assessment.
State of Arizona MHMP (2018)	Hazard Mitigation Plan	Source of information on the state-identified hazards, mitigation goals, and risk assessment.
U.S. Forest Service	Technical Data	Source for local wildfire data. Used in the risk assessment.
U.S. Geological Survey	Technical Data	Source for geological hazard data and incident data. Used in the risk assessment.
Western Regional Climate Center	Website Data	Online resource for climate data and discussion in community descriptions and risk assessment.

## SECTION 5: RISK ASSESSMENT

One of the key elements of the hazard mitigation planning process is risk assessment. In performing a risk assessment, a community determines "what" can occur, "when" (how often) it is likely to happen, and "how bad" the effects could be.<sup>8</sup> According to the Disaster Mitigation Act of 2000, the primary components of a risk assessment that answer these questions are generally categorized into the following measures:

- Hazard Identification and Screening
- Hazard Profiling
- Assessing Vulnerability to Hazards

The risk assessment for Cochise County and participating jurisdictions was performed using a county-wide, multi-jurisdictional perspective, with much of the information gathering and development being accomplished by the Planning Team. This integrated approach was employed because many hazard events are likely to affect numerous jurisdictions within the County and are not often relegated to a single jurisdictional boundary. The vulnerability analysis was performed to reflect vulnerability at an individual jurisdictional and county-wide level.

### 5.1 Hazard Identification and Screening

Hazard identification answers the question, *"What hazards can and do occur in my community or jurisdiction?"* For this Plan, the list of hazards identified in the 2017 Plan was reviewed by the Planning Team to refine the list to reflect the hazards that pose the greatest risk to the jurisdictions represented by this Plan. The Planning Team also compared and contrasted the 2017 Plan list to the comprehensive hazard list summarized in the 2018 State Plan<sup>9</sup> to ensure compatibility with the State Plan. The following table summarizes the hazards profiled in the 2017 Plan, the 2018 State Plan, and this updated 2022 Plan.

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<sup>8</sup> National Fire Protection Association. (2019). NFPA 1600: Standard on Continuity, Emergency, and Crisis Management. NFPA.

<sup>9</sup> Arizona Department of Emergency and Military Affairs. (2018). *State of Arizona Hazard Mitigation Plan*. (DEMA Planning Branch, Ed.) Retrieved November 5, 2022, from [https://dema.az.gov/sites/default/files/publications/EM-PLN\\_State\\_Mit\\_Plan\\_2018.pdf](https://dema.az.gov/sites/default/files/publications/EM-PLN_State_Mit_Plan_2018.pdf)

Table 5.1. Summary of Initial Hazard Identification Lists		
2017 Cochise County Plan Hazard List	2018 State Plan Hazard List	2022 Cochise County Plan Hazard List
<ul style="list-style-type: none"> <li>• Building Collapse/Mine Subsidence</li> <li>• Drought</li> <li>• Fissure</li> <li>• Flood/Flash Flood</li> <li>• Hazardous Materials Incidents</li> <li>• Severe Wind</li> <li>• Wildfire</li> </ul>	<ul style="list-style-type: none"> <li>• Dam Failure</li> <li>• Drought</li> <li>• Earthquake</li> <li>• Extreme Heat</li> <li>• Fissures</li> <li>• Flooding</li> <li>• Hazardous Materials Incidents</li> <li>• Infectious Disease</li> <li>• Landslides</li> <li>• Levee Failure</li> <li>• Severe Wind</li> <li>• Subsidence</li> <li>• Terrorism</li> <li>• Wildfires</li> <li>• Winter Storms</li> </ul>	<ul style="list-style-type: none"> <li>• Building Collapse/Mine Subsidence</li> <li>• Drought</li> <li>• Earthquake</li> <li>• Fissure</li> <li>• Flood/Flash Flood</li> <li>• Severe Wind</li> <li>• Wildfire</li> </ul>

The review included an initial screening process to evaluate each of the listed hazards based on the following considerations:

- Experiential knowledge on behalf of the Planning Team concerning the relative risk associated with the hazard,
- The documented historical context for damages and losses associated with past events (especially events that have occurred during the last plan cycle),
- The ability of jurisdictions to develop effective mitigation actions for the hazard under current DMA 2000 criteria,
- Consideration of the new FEMA National Risk Index hazards for Cochise County,
- Compatibility with the state hazard mitigation plan, and
- Duplication of effects attributed to each hazard with other planning and preparedness efforts.

The following Table 5.2 summarizes the federal and state disaster declarations that included Cochise County from 1990 through 2021.



Table 5.2. Arizona State and Federal Declarations Involving Cochise County - January 1990 to December 2021

Plan Hazard	Disaster and Area	State Declaration Date	Federal Declaration Date	State Declaration Terminated	State Expenditures	Federal Expenditures
Wildfire	Wildland Fire Contingency - Statewide	03/17/90		03/04/92		
	Search and Rescue - Statewide	06/13/05		Continuing		
Flooding	Statewide Flood - Apache, Cochise, Coconino, Graham, Gila, Greenlee, Maricopa, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma Counties.	01/08/93		11/15/02	\$ 30,072,157	\$ 104,069,362
Wildfire	Wildfire Suppression Statewide - Department of Land	09/09/93		02/02/95	\$ 200,000	
Wildfire	Wildfire Suppression - Statewide - Department of Lands	10/14/94		02/02/95	\$ 600,000	
	Wheat (Karnal Bunt) - Statewide	03/13/96		10/21/98	\$ 796,455	
Wildfire	Wildfire - Statewide	05/16/96		10/21/98	\$ 1,000,728	
Drought	Drought - Statewide	06/07/96		10/22/98	\$ 211,499	
	Red Imported Fire Ant Emergency - State of Arizona	01/20/99		01/20/01	\$ 177,702	
Wildfire	Wildland Fire Emergency - State of Arizona	05/06/99		05/10/00	\$ 4,894	
Drought	Drought Emergency - State of Arizona	06/23/99				
Flooding	Flash Flood Emergency - Cochise County	08/16/99		11/15/02	\$ 1,091,188	
	Y2K - State of Arizona	01/05/00		02/23/00	\$ 23,073	

Table 5.2. (cont.) Arizona State and Federal Declarations Involving Cochise County - January 1990 to December 2021

Plan Hazard	Disaster and Area	State Declaration Date	Federal Declaration Date	State Declaration Terminated	State Expenditures	Federal Expenditures
	Arizona 2000 Flood Emergency - Cochise, La Paz, Maricopa, Pinal, Santa Cruz Counties	10/23/00	10/27/00	02/19/10	\$ 1,432,117	\$ 5,471,560
	September Terrorism Incident - State of Arizona	09/12/01		05/19/09	\$ 2,913,677	
	Military Airport Security - State of Arizona	10/16/01		04/05/02	\$ 8,110	
Wildfire	Forest Health Emergency - State of Arizona	05/22/03		05/19/09	\$ 2,378,06	
	Border Security Emergency - Cochise, Pima, Santa Cruz, Yuma Counties	08/15/05		05/19/09	\$ 1,492,758	
	Operation Good Neighbor - State of Arizona	09/03/05	09/12/05	10/12/12	\$ 113,040	\$ 5,726,164
Wildfire	Wildfire Resources Emergency - State of AZ (Pre-suppression)	02/22/06		02/07/08	\$ 192,390	
	Glassy-Winged Sharpshooter Infestation - Cochise, Maricopa, Pima, Pinal, Santa Cruz, Yuma Counties	6/23/2006		05/19/09	\$ 567,257	
Wildfire	Horseshoe Two & Monument Fires - Cochise County	06/17/11		10/12/12	\$ 99,017	
Flooding	Tombstone Waterline Flooding - City of Tombstone	08/17/11		02/05/13	\$ 38,048	
Flooding	Cochise County Flooding - Cochise County	11/04/14		05/01/18	\$ 1,718,456	
	Opioid Health Emergency - State of Arizona	06/05/17		05/29/18		

Table 5.2. (cont.) Arizona State and Federal Declarations Involving Cochise County - January 1990 to December 2021

Plan Hazard	Disaster and Area	State Declaration Date	Federal Declaration Date	State Declaration Terminated	State Expenditures	Federal Expenditures
Wildfire	Bisbee Fire - City of Bisbee	06/21/17		07/13/18	\$ 15,021	
Wildfire	Arizona Wildfire Suppression Emergency - Statewide	04/23/17		06/30/17	\$ 5,450,375.34	
	COVID-19 - Apache, Cochise, Coconino, Greenlee, Graham, Gila, La Paz Maricopa, Mojave, Navajo, Pima, Pinal, Santa Cruz, Yavapai, Yuma Counties.	03/11/20	03/20/20			
	Riots - Phoenix, Flagstaff, Gilbert, DPS, Kingman, Cochise County, Eloy, NAU, Pima County, Tucson, ASU, Buckeye, Chandler, Glendale, Maricopa County Sheriff's Office, Mesa, Paradise Valley, Scottsdale, Surprise, Tempe	05/31/20 12/21/2020			\$ 200,000	
	Border Crisis - Cochise County, Maricopa County, Pima County, Pinal County, Santa Cruz County, Yuma County	4/20/2021				
				<b>Total Expenditures</b>	\$ 50,796,030	\$ 115,267,086
Source: AZDEMA Infrastructure Branch, October 2022, URL: <a href="https://dema.az.gov/emergency-management/operationscoordination/recovery-branch/infrastructure">https://dema.az.gov/emergency-management/operationscoordination/recovery-branch/infrastructure</a>						

The result of the Planning Team's review of hazards led to no removals or additions since the 2017 revision. The Team reviewed Dam Failure, Lightning, and Hazardous Materials specifically, but ultimately, they are handled elsewhere in a related hazard in this document or alternate planning efforts. The hazards chosen for this plan are in Table 5.1 and covered in this section.

## **5.2 Vulnerability Analysis Methodology**

### **5.2.1 General**

The following sections summarize the methodologies used to perform the vulnerability analysis portion of the risk assessment. For this Plan, the vulnerability analysis was updated to reflect new requirements and refine the hazard information. For example, the Team chose not to use HAZUS data for this revision but incorporated further information from the FEMA National Risk Index and other GIS technologies as specified.

For this vulnerability analysis, hazard profile maps were developed for Mine Subsidence/Building Collapse, Earthquake, Fissure, Flooding/Flash Flooding, and Wildfire to map the geographic variability of the probability and magnitude risk of the hazards as estimated by the Planning Team. Maps were created in-house with the Cochise County GIS team.

Unless otherwise specified in this Plan, the general cutoff date for new hazard profile data and corporate jurisdictional limits is October 2022.

### **5.2.2 Calculated Priority Risk Index (CPRI) Evaluation**

The first step in the vulnerability analysis is to assess the perceived overall risk for each chosen hazard using the Calculated Priority Risk Index (CPRI). The CPRI value is obtained by assigning varying degrees of risk to four categories for each hazard and then calculating an index value based on a weighting scheme. Table 5-3 summarizes the CPRI risk categories and guides assigning values and weighting factors for each category.

The CPRIs were completed for each hazard chosen by each jurisdiction and the Cochise County jurisdictional Planning Team. They were reviewed after completion during one of the milestone planning meetings. The results of the CPRI evaluation for each hazard are in the specific hazard section.

Table 5.3. Calculated Priority Risk Index Categories and Risk Levels

CPRI Category	Degree of Risk			Assigned Weighting Factor
	Level ID	Description	Index Value	
Probability	Unlikely	<ul style="list-style-type: none"> <li>Extremely rare with no documented history of occurrences or events.</li> <li>Annual probability of less than 0.001.</li> </ul>	1	45%
	Possibly	<ul style="list-style-type: none"> <li>Rare occurrences with at least one documented or anecdotal historic event.</li> <li>Annual probability that is between 0.01 and 0.001.</li> </ul>	2	
	Likely	<ul style="list-style-type: none"> <li>Occasional occurrences with at least two documented historic events.</li> <li>Annual probability that is between 0.1 and 0.01.</li> </ul>	3	
	Highly Likely	<ul style="list-style-type: none"> <li>Frequent events with a well-documented history of occurrence.</li> <li>Annual probability that is greater than 0.1.</li> </ul>	4	
Magnitude/Severity	Negligible	<ul style="list-style-type: none"> <li>Negligible property damages (less than 5% of critical and non-critical facilities and infrastructure).</li> <li>Injuries/illnesses are treatable with first aid and no deaths.</li> <li>Negligible quality of life lost.</li> <li>Shut down of critical facilities for less than 24 hours.</li> </ul>	1	30%
	Limited	<ul style="list-style-type: none"> <li>Slight property damages (greater than 5% and less than 25% of critical and non-critical facilities and infrastructure).</li> <li>Injuries/illnesses do not result in permanent disability and no deaths.</li> <li>Moderate quality of life lost.</li> <li>Shut down of critical facilities for more than 1 day and less than 1 week.</li> </ul>	2	
	Critical	<ul style="list-style-type: none"> <li>Moderate property damages (greater than 25% and less than 50% of critical and non-critical facilities and infrastructure).</li> <li>Injuries/illnesses result in permanent disability and at least one death.</li> <li>Shut down of critical facilities for more than 1 week and less than 1 month.</li> </ul>	3	
	Catastrophic	<ul style="list-style-type: none"> <li>Severe property damages (greater than 50% of critical and non-critical facilities and infrastructure).</li> <li>Injuries/illnesses result in permanent disability and multiple deaths.</li> <li>Shut down of critical facilities for more than 1 month.</li> </ul>	4	
Warning Time	Less than 6 hrs	Self-explanatory.	4	15%
	6 to 12 hrs	Self-explanatory.	3	
	12-24 hrs	Self-explanatory.	2	
	More than 24 hours	Self-explanatory.	1	
Duration	Less than 6 hrs	Self-explanatory.	1	10%
	Less than 24 hrs	Self-explanatory.	2	
	Less than one week	Self-explanatory.	3	
	More than one week	Self-explanatory.	4	

#### 5.2.4 Asset Inventory

HAZUS was not used for this revision as there was no way to integrate the data meaningfully. Jurisdictions and the County were asked to identify their critical facilities and infrastructure and discuss these during their vulnerability reviews for each hazard.

The following definitions were considered:

*Assets* are any natural or human-caused feature that has value, including, but not limited to, people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

*Critical facilities and infrastructure* are systems, structures, and infrastructure within a community whose incapacity or destruction would:

- Have a debilitating impact on the defense or economic security of that community
- Significantly hinder a community's ability to recover following a disaster

The criteria used for critical facilities and infrastructure consideration are:

1. Communications Infrastructure: Telephone, cell phone, data services, radio towers, and internet communications, which have become essential to the continuity of business, industry, government, and military operations.
2. Electrical Power Systems: Generation stations and transmission and distribution networks that create and supply electricity to end-users.
3. Gas and Oil Facilities: Production and holding facilities for natural gas, crude and refined petroleum, and petroleum-derived fuels, as well as the refining and processing facilities for these fuels.
4. Banking and Finance Institutions: Banks, financial service companies, payment systems, investment companies, and securities/commodities exchanges.
5. Transportation Networks: Highways, railroads, ports and inland waterways, pipelines, and airports and airways that facilitate the efficient movement of goods and people.
6. Water Supply Systems: Sources of water; reservoirs and holding facilities; aqueducts and other transport systems; filtration, cleaning, and treatment systems; pipelines; cooling systems; and other delivery mechanisms that provide for domestic and industrial applications, including systems for dealing with water runoff, wastewater, and firefighting.
7. Government Services: Capabilities at the local, tribal, state, and federal levels of government are required to meet the needs for essential services to the public.
8. Emergency Services: Medical, police, fire, and rescue systems.

The following Table 5.4 summarizes the facility counts provided by each participating jurisdiction in this Plan.

Table 5.3 Asset Inventory Structure Counts by Category and Jurisdiction								
Jurisdiction	Communications Infrastructure	Electrical Power Systems	Gas and Oil Facilities	Banking and Finance Institutions	Transportation Networks	Water Supply Systems	Government Services	Emergency Services
<b>County-Wide Totals</b>	150	41	36	20	14	44	72	64
<b>Benson</b>	3	6	10	0	3	12	6	4
<b>Bisbee</b>	3	2	5	4	1	5	11	0
<b>Douglas</b>	4	0	2	7	0	0	8	7
<b>Huachuca City</b>	1	0	1	0	0	1	4	1
<b>Sierra Vista</b>	25	9	2	0	1	4	12	12
<b>Tombstone</b>	2	0	0	1	0	8	7	3
<b>Willcox</b>	7	3	7	4	1	6	6	6



Table 5.4 Asset Inventory Structure Counts by Category and Jurisdiction								
Jurisdiction	Communications Infrastructure	Electrical Power Systems	Gas and Oil Facilities	Banking and Finance Institutions	Transportation Networks	Water Supply Systems	Government Services	Emergency Services
County-Wide Totals Unincorporated Totals	150	41 (add 1)	36	20	14	44	72	64
Benson	3	6	10	0	3	12	6	4
Bisbee	3	2	5	4	1	5	11	0
Douglas	7	1	4	5	2	10	12	14
Huachuca City	2	0	2	0	1	2	4	2
Sierra Vista	25	9	2	10	1	4	12	12
Tombstone	3	0	0	1	1	10	7	3
Willcox	7	3	7	4	1	6	6	6

### 5.2.5 *Loss Estimations*

Loss estimates for this Plan reflect the best available data utilizing current hazard map layers, the FEMA National Risk Index, Census 2020 block-level data, and other tools and sources as noted, including jurisdictional reports and expertise.

Several of the hazards profiled in this Plan will not include quantitative exposure and loss estimates. The vulnerability of people and assets associated with some risks is nearly impossible to evaluate given the uncertainty of where these hazards will occur and the relatively limited focus and extent of the damage. Instead, a qualitative review of vulnerability will be discussed to provide insight into the nature of losses associated with the hazard. For subsequent updates of this Plan, the data needed to evaluate these unpredictable hazards may become refined such that comprehensive vulnerability statements and thorough loss estimates can be made. With every revision, more tools and resources are available for this effort.

### 5.2.6 *Development Trend Analysis*

This 2022 Plan assessed the most recent County GIS data sets relating to development and growth areas when conducting the risk and vulnerability assessment. The updated analysis focused on the potential risk associated with projected growth patterns and their intersection with the Plan identified hazards. Each jurisdiction was asked to provide a narrative about the hazard related to development trends in their area.

## 5.3 **Hazard Risk Profiles**

The following sections summarize the risk profiles for each of the Plan hazards identified in Section 5.1. For each hazard, the following elements are addressed to present the overall risk profile:

- Description
- History
- Probability and Magnitude
- Extent
- Vulnerability
  - CPRI score
  - Vulnerability Discussion
  - Loss Estimations
  - Changes in Development in Hazard Areas
- Profile Maps (if applicable)

Much of the 2017 Plan data has been updated, incorporated, or revised to reflect current conditions and Planning Team additions. County-wide and jurisdiction-specific profile maps are provided at the end of the section if applicable.

Sources of data are either noted in footnotes or under specific figures.

### 5.3.1 Building Collapse / Mine Subsidence

#### Description

Building collapse can result from many hazards, whether natural or artificial, such as earthquakes, liquefaction, explosives, structural design, etc. Within the scope of this Plan, building collapse has great potential due to subterranean activities that have taken place in the past and present. "Building Collapse" as a hazard will incorporate buildings, roadways, and infrastructures that may be exposed or vulnerable to failure due to the collapse or implosion of underground cavities. The following are some of the causes that have the potential to cause building collapse in Cochise County:

- Mine Subsidence occurs when the ground surface moves due to collapse or failures of underground mine workings. Underground mining is used when minerals are deep beneath the surface or when ore grade or quality is sufficient to justify more targeted mining. To get to the ore bodies, a vertical shaft, horizontal access shaft, or inclined passageway must be drilled or excavated to remove ore and waste and supply ventilation. Once the ore body is exposed, several levels of horizontal tunnels called drifts and crosscuts are created to provide access to mining areas called stopes. The area being mined at any given time is called the face. The broken rock is hauled from the face by trains, loaders, or trucks that go directly to the surface or to the shaft, where it is hoisted to the surface and sent to a processing facility.
- Underground Infrastructure Erosion occurs in stormwater channels built underground during the turn of the century, which are inadequate to carry the necessary amount or volume of water without causing significant deterioration and erosion of channel walls and supports.
- Criminal Tunneling occurs when organized crime along the U.S./Mexico border desires to transport humans and contraband across the border in subterranean tunnels to evade capture. The tunnels are typically structurally crude and dangerous due to the lack of proper structural support, especially when unsuspecting surface construction or vehicular traffic causes additional static and dynamic loading above the tunnels. Sometimes, these tunnels may inadvertently intercept storm runoff and divert the flows to areas not designed to carry flood waters.

The secondary effects which result from the three mentioned above are:

- *Sinkhole subsidence* occurs in areas overlying underground voids or openings relatively close to the ground surface. This subsidence is fairly localized and usually recognized by an abrupt depression at the ground surface as overburdened materials collapse into the void. Sinkhole subsidence is probably the most common type of subsidence that occurs and has been responsible for extensive damage to many structures throughout the years.
- *Subsidence troughs* over abandoned tunnels/mines usually occur when the overburden sags downward due to the failure of remnant mine pillars or by punching the pillars into a soft mine roof or floor. The surface effect is a large, shallow, yet broad depression in the ground that is usually elliptical or circular in shape. Subsidence is typically most significant at the center of the trough and continually decreases until the limit of the surface area is reached. Structures near the center of the trough can experience damage caused by the compression of the ground surface, and structures near the edges can be damaged by tension or stretching of the surface. Ground movement within a subsidence trough can damage buildings, roadways, bridges, railroads, underground pipelines and utilities, and

practically any other structure or feature that may be present.<sup>10</sup>

## History

*Tombstone* - Historic, underground mining activities have occurred throughout Cochise County, leaving many abandoned mine shafts and tunnels. Many of these mines are located in remote hillside areas. The City of Tombstone, however, is an exception. Within the city limits, much stope mining has occurred, and many of the City's treasured historic structures have been constructed directly over the top of these abandoned mine workings. The six-block historical district of Tombstone sits on top of numerous subterranean mines/shafts in and around the City, as represented in Figure 5.2. Innumerable foundations of buildings are placed directly on top of voids of tunnels and open mineshafts. To compound this hazard, the construction of most of Tombstone's historic buildings does not conform with current local building codes. There is an added concern that a minor earthquake may trigger a catastrophic mine subsidence event, although the Planning Team recognizes that the frequency of earthquakes is rare. The following are recorded subsidence events that have occurred within the City of Tombstone:

- In July 1997, the City suffered a subsidence event on East Toughnut Street, between South 4<sup>th</sup> Street and South 5<sup>th</sup> Street, developing inch-wide cracks in a depression approximately 55 feet in diameter and one foot deep, causing a street closure and threatening the City's main sewer line, which run down the center of East Toughnut Street. The eventual sag broke open, exposing a hole at least 25 feet deep, also taking an adobe wall and breaking a secondary sewer line. The portion of the street suffering the subsidence was closed to vehicular traffic, which appeared to cure the problem.
- On January 2, 1998, another collapse occurred and, within a few days, widened to six to eight feet in diameter with a secondary sewer line broken and discharging raw effluent in the Old Goodenough Mine and, by default, into the City's groundwater. A state of emergency was declared, and \$10,000 was allocated to repair the sewer line and rectify the matter.<sup>11</sup>
- In August 2022, monsoon rains caused a collapse near the Vizina Mining Claim. The collapse opened up a sinkhole 50 feet away from Toughnut Street.<sup>12</sup> Figure 5.1

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<sup>10</sup> U.S. Department of Energy. (2002). Energy and Environmental Provide of tue U.S. Mining Industry. Retrieved July 29, 2022, from <https://www.energy.gov/sites/prod/files/2013/11/f4/overview.pdf>

<sup>11</sup> McCracken, K. (1998). Subsidence Mitigation in Tombstone, Arizona. *20th Annual Conference of the Association of Abandoned Mine Land Programs*. Albuquerque.

<sup>12</sup> Fernandez, C. J. (2019, August 19). Recent rains cause mine to collapse in Tombstone. Retrieved September 15, 2022, from <https://www.kgun9.com/news/local-news/recent-rains-cause-mine-to-collapse-in-tombstone>



Figure 5.1. Sinkhole Mine Collapse in Tombstone

There have been limited incidents associated with this general category aside from a few sinkholes to those noted above. One a few inches in diameter near 4th and Toughnut in 2021. Another larger one (about 10' across and about 4' deep) in a dirt parking lot near 3rd and Survey Street, and one of unknown size at 1st and Fremont Street. None caused any peripheral damage, and all were easily rectified.

According to the City of Bisbee General Plan, Old Bisbee experienced multiple flooding events around the turn of the century due to the rapid growth and development of the natural floodplains along the canyons formed by the Mule and Brewery Gulches. Multiple attempts at flood control facilities failed to adequately control the frequent summer monsoon events that threatened the City. Finally, in December 1908, a contract was awarded to El Paso and Southwestern Railroad Company to construct a new underground concrete channel to effectively convey the flood waters. A portion of this channel would run behind the buildings on the south and parallel to Main Street, connect to an inlet located on the street surface that collects water flows from Brewery Gulch, and continue in the underground channel along Naco Road. This 100-year-old channel, Mule Gulch Channel, continues to function today to divert water to protect the downtown area of Old Bisbee.

A more recent U.S. Army Corps of Engineers study that was completed after the 1986 flood revealed that the channel was undersized and severely deteriorated, which posed a high probability of failure. Subsequent investigations by the Corps and the City of Bisbee revealed that the channel was undersized, severely deteriorated, and posed a high likelihood of failure. In 1999, the City of Bisbee solicited emergency funding from the state and the federal government after monsoon rains caused flooding and damaged the channel. With \$1.4 million in financing obtained, the City began constructing the initial phase of channel rehabilitation in April 2001. On January 18, 2001, a portion of a parking lot in the historic district collapsed into the underground channel. A rotted support beam of the covered channel shattered, dropping a section of the Busy Bee parking lot into the Mule Gulch drainage channel. Fortunately, no one was hurt in the

collapse. The Mule Gulch Drainage Channel restoration project along Tombstone Canyon-Main Street was completed in 2002.<sup>13</sup>

Bisbee's other areas of concern with underground infrastructure erosion include that the town is honeycombed with old mine shafts and tunnels from mining activity dating from the turn of the century to mid-century. Subsidence could occur in most of Bisbee. Also, Old Bisbee's Naco Road/Commerce Street area is vulnerable to subsidence from deteriorated channel walls and ceilings.

Douglas – Along the U.S and Mexico border, numerous drug smuggling tunnels have been discovered in the Tucson Sector, including Nogales, Douglas, and Naco. Many of the tunnels are discovered by roads collapsing. A few examples of tunnel events for Douglas are listed below:

- In 1990, a 270-foot elaborate tunnel with lighting and a hydraulic system valued at more than \$1 million was discovered between the town of Agua Prieta (in the Mexican state of Sonora) and Douglas, Arizona. An investigation revealed that more than a metric ton (2,250 pounds) of cocaine had been smuggled through that tunnel from Mexico into the United States.
- In August 2011, a tunnel collapsed in Douglas, Arizona, leading from a rental house 25 feet south of the house. An entry on the Mexico side of the border could not be located. The rental house is just a few feet from the international border and east of the Douglas Port of Entry on C Avenue and International Street. The discovery was made by a nearby resident who entered the house and found a 14-inch diameter hole in the floor.<sup>14</sup>
- In August 2017, a city employee reported a suspicious opening south of Chino Road, later confirmed to be a collapsed illicit tunnel that extended approximately 60 yards into the United States from Mexico.<sup>15</sup>

Many of the residential structures still in existence today in Douglas are comprised of adobe brick and plaster and were built before or shortly after the founding of Douglas in 1901. Age, neglect, and design flaws have contributed to a number of these structures being condemned or demolished as a result:

- In August 2014, a residence at the 800 block of 1st Street, inhabited but unoccupied at the time, suffered a collapse of an external wall (adobe brick). Responding Fire and Public Works crews noted additional stress fractures in the remaining walls resulting in the emergency abatement of the affected sections of the residence by City crews, with the owner opting to demolish the structure for safety. The collapse occurred following

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<sup>13</sup> The Planning Center. (2003). City of Bisbee General Plan Update., *Volume 1*. Retrieved July 29, 2022, from [https://www.bisbeeaz.gov/DocumentCenter/View/1141/2015GeneralPlanUpdateVolume1Final\\_001June-2014?bidId=](https://www.bisbeeaz.gov/DocumentCenter/View/1141/2015GeneralPlanUpdateVolume1Final_001June-2014?bidId=)

<sup>14</sup> Herald Review. (2011, August 24). Possible Drug Tunnel Discovered in Nogales. Retrieved October 27, 2022, from [https://www.myheraldreview.com/news/douglas/possible-drug-tunnel-discovered-in-douglas/article\\_f10f4d8e-b970-51aa-bb03-bbaf0255e128.html](https://www.myheraldreview.com/news/douglas/possible-drug-tunnel-discovered-in-douglas/article_f10f4d8e-b970-51aa-bb03-bbaf0255e128.html)

<sup>15</sup> Herald Review. (2017, November 26). Suspicious Tunnel Prompts Investigation. Retrieved October 27, 2022, from [https://www.myheraldreview.com/news/suspicious-tunnel-prompts-investigation/article\\_af355398-d205-11e7-a0c0-a74609c53161.html](https://www.myheraldreview.com/news/suspicious-tunnel-prompts-investigation/article_af355398-d205-11e7-a0c0-a74609c53161.html)

a monsoon storm where approximately 1.47 inches of rain in a short time.<sup>16</sup>

- In August 2018, an unoccupied commercial structure at the 500 block of 9th Street suffered stress fractures at the base of an external wall (gypsum block) due to stormwater infiltration into the structure due to abandonment/neglect. The City of Douglas code Enforcement condemned the building, and the structure was demolished.
- In July 2021, an unoccupied residence at the 200 block of 18th Street was tagged and scheduled for demolition due to structural integrity (adobe brick). Before demolition, the structure's back wall was struck by lightning, essentially blowing it out. Demolition was moved up, and the structure was demolished.
- In March 2022, an apartment complex at 7th Street and H Avenue was tagged and scheduled for demolition due to structural integrity (adobe brick) due to neglect and water damage. The action was initiated by the City of Douglas Code Enforcement, with the property owner completing the demolition.

### Probability and Magnitude

The probability and magnitude of building collapse will vary greatly depending on ground surface stability and development activities. The state of the mines in Tombstone will continue to degrade over time. The infrastructure in Bisbee is still degrading. Criminal tunneling will continue along the border. Earthquakes may also trigger or cause a mine collapse that could cause major damage to the structures. Significant seismic activity is deemed unlikely due to the long re-occurrence interval reported by the U.S. and Arizona Geological Surveys.

A Main Street portion of the Mule Gulch drainage channel has been rehabilitated in Bisbee as described above. Still, several reaches of the Tombstone Canyon structure remain in need of repair and threaten nearby homes and businesses.

The tunneling efforts for human and drug trafficking will likely continue along the border; however, most tunneling activity occurs around Nogales in Santa Cruz County. Douglas and the Naco area remain vulnerable.

One way to estimate the risk of building collapse is to map the limits of the underground voids or hazard areas, evaluate their corresponding limits of influence due to a collapse, and determine the structure and population exposure. At this writing, the Planning Team reached out to the Arizona State Mine Inspector's Office for more information, but no response was provided. Data for the other hazard areas was unavailable for this Plan but attempts to better map this hazard for the next revision are underway. Figure 5.2 displays a city-wide map of the City of Tombstone, which shows the building collapse high hazard area. The National Risk Index does not contain risk relative to this hazard other than through the earthquake hazard, which could initiate collapse.

### Extent

The extent of mine subsidence/building collapse within this Plan is limited to areas of prior mine tunneling, smuggling tunneling, and collapsing water conveyance infrastructure. The City of Bisbee

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<sup>16</sup> Whetton, B. (2014, September 3). Storm causes house collapse: dumps 1.47 inches of rain. *Douglas Dispatch*. Retrieved October 27, 2022, from [https://www.myheraldreview.com/news/douglas/storm-causes-house-collapse-dumps-1-47-inches-of-rain/article\\_761ac09f-5798-5dee-bdbb-cdeef11fe786.html](https://www.myheraldreview.com/news/douglas/storm-causes-house-collapse-dumps-1-47-inches-of-rain/article_761ac09f-5798-5dee-bdbb-cdeef11fe786.html)

may suffer underground infrastructure erosion from building collapse during a significant rainstorm causing the drainage channel to fill with large volumes of rushing water. With large amounts of rainfall, old 100-year-old retaining walls become vulnerable to collapse, with many annual examples.

The City of Douglas and the unincorporated Naco area could be impacted by criminal tunneling anywhere along the border and not fixed to any particular location. This area will continue to be vulnerable to a moving hazard as the criminal element will determine the location of the underground tunnels. It should be noted that the Planning Team recognizes that the probability of a building collapse occurring at multiple (or all) places at the same time is essentially zero.

Though there have been relatively few historical incidents, Tombstone has over 300 miles of mines under the City, so the potential is always there for a collapse of unknown magnitude, with no warning, causing an indeterminate amount of damage and interrupting normal commute or commerce for a variable length of time.

Huachuca City currently has two buildings that would be of concern for collapse. Both buildings are unoccupied at this time. Damage risk would be contained to these properties, and there are no mining operations in the City.

Currently, the City of Willcox does not have structures or infrastructure it deems susceptible to Building Collapse/Mine Subsidence in the municipal inventory.



### Vulnerability – CPRI Results

Building collapse CPRI results for each jurisdiction are summarized in the following table.

Table 5-4. CPRI Results for Building Collapse / Mine Subsidence					
Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Benson	2.00	2.00	3.50	2.00	<b>2.23</b>
Bisbee	3.00	2.00	4.00	3.00	<b>2.85</b>
Douglas	3.00	1.00	1.00	2.00	<b>2.00</b>
Huachuca City	1.50	1.00	1.00	1.00	<b>1.23</b>
Sierra Vista	1.00	3.00	2.00	1.00	<b>1.75</b>
Tombstone	3.00	1.00	4.00	2.50	<b>2.50</b>
Willcox	0.50	0.50	0.75	0.25	<b>0.51</b>
Unincorporated County	1.25	1.00	4.00	2.00	<b>1.66</b>
County-wide average CPRI =					<b>1.84</b>

Based on the CPRI Evaluation, the City of Bisbee and Tombstone believe they are most at risk from a Building Collapse/Mine Subsidence event. As demonstrated in the table above, the probability of this event occurring in these two jurisdictions is more likely, and the magnitude of event impacts would be more significant.

### Vulnerability – Loss Estimations

Estimating potential losses due to building collapse was conducted by intersecting the human and facility assets with the building collapse/mine subsidence hazard limits depicted in Figure 5.2. As stated previously, building collapse data was only readily available for the City of Tombstone. Therefore, the results of this analysis are expected to underestimate the exposure of people and infrastructure within Cochise County.

Since no standard methodology is available for obtaining losses from the exposure values, analysis of dollar losses attributable to this hazard are estimations. Exposure estimates to all facilities within the high-hazard area are based on the proximity of mine subsidence areas directly beneath historical buildings. In Tombstone, most of the assets located within high-hazard mine subsidence areas, such as the Nellie Cashman Restaurant, Old Firehouse, Big Nose Cave Saloon, Crystal Palace, and the Library, are subject to unstable foundations due to the subterranean voids below the ground surface within the City of Tombstone. Other impacts to both buried and above-ground utilities are likely in a mine subsidence event.

Over \$50.0 million in the City of Bisbee critical facilities are estimated to be exposed to a high building collapse/mine subsidence hazard. The cost of replacing historic buildings is an additional \$50 million, including private homes and business structures. Regarding human vulnerability, 25% of the City of Bisbee's total population, or 1,250 people, are potentially exposed to a high building

collapse/mine subsidence hazard event or retaining wall failure causing a domino effect in the heart of the historic district.

\$20.0 million in the City of Tombstone's critical facilities (nearly 10% of all the essential facilities in Tombstone) are estimated to be exposed to a high building collapse/mine subsidence hazard. Over 3% of all the residential housing units in Tombstone were estimated to be exposed to a high building collapse/mine subsidence hazard. Multiple deaths and injuries are plausible, and a portion of the exposed population is subject to displacement, depending on the event's magnitude.

For Douglas, criminal tunneling loss estimations are difficult to determine. The magnitude/severity of such an occurrence is considered negligible as most affected structures are residential and do not include critical facilities and infrastructure. Douglas Code Enforcement has been actively working to identify and address vulnerable properties through direct corrective action by the property owner or the City's abatement program.

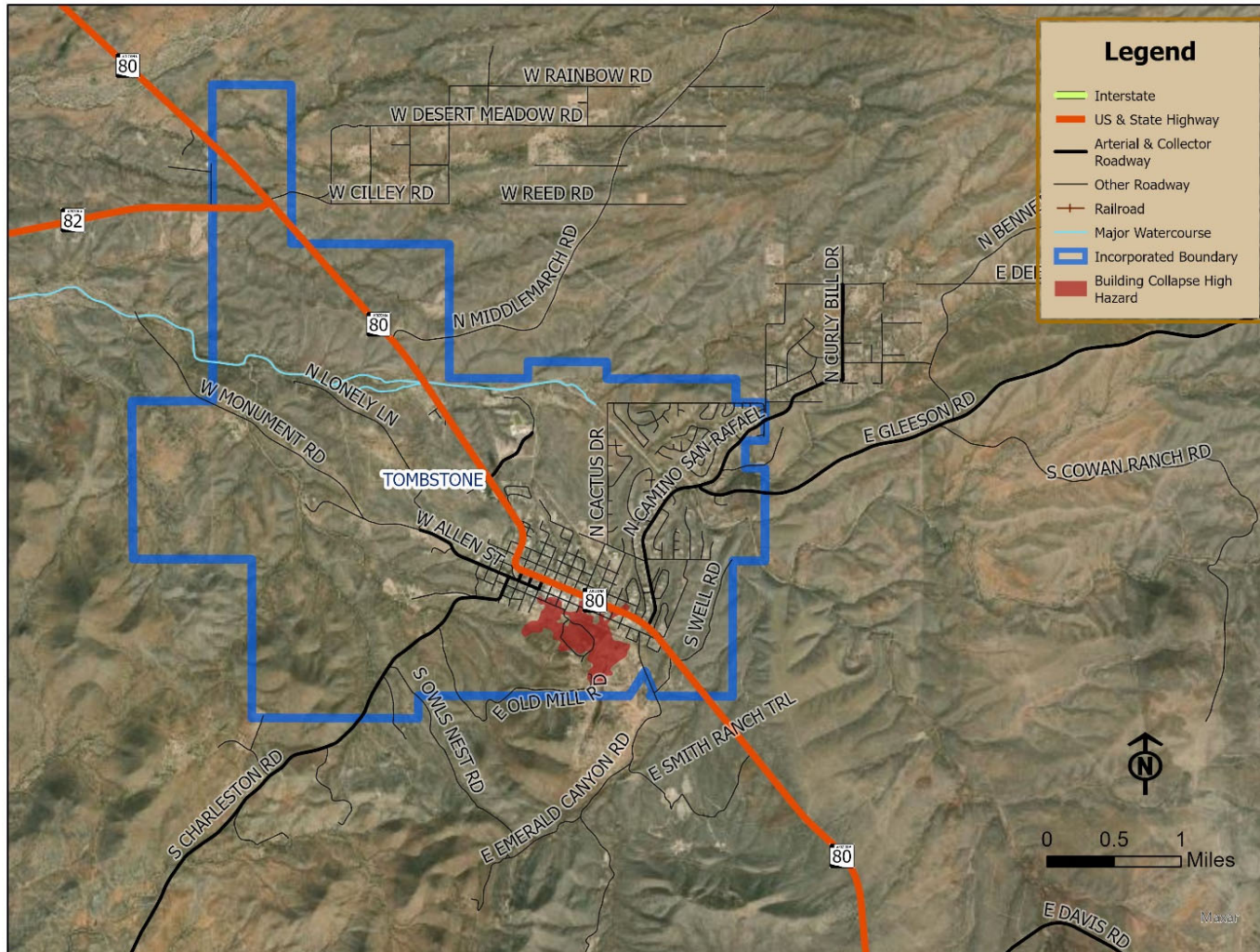
#### Vulnerability – Development Trend Analysis

Development of the high-hazard areas indicated on the map at the end of this section has been very limited and limited to no growth is expected in these areas. Future development of those areas will require extensive geotechnical investigations to ensure the stability and longevity of any structures. This would hold for both the mine subsidence areas and the tunneling areas.

High-risk areas within Bisbee are generally not subject to future development plans except for simple repairs and renovations. Any future development of significance will require a structural evaluation of the current drainage channel and retaining walls to determine the adverse impacts of structural loading on the nearly 100-year-old systems and walls. A failure modes evaluation and analysis may be warranted with a larger area redevelopment.

There has been no new mining for decades under the City of Tombstone. The local mines utilized for tours are well-maintained and monitored by competent personnel. There is no planned development

Figure 5.3. City of Tombstone Building Collapse



### 5.3.2 Drought

#### Description

Drought is a normal part of most climates across the globe, including rainforest and desert climates. It differs from normal aridity, a permanent characteristic of arid and semi-arid environments. Drought results from a decline in the expected precipitation over an extended period, often one or more seasons in length. FEMA defines drought as "a deficiency of precipitation over an extended period resulting in a water shortage."<sup>17</sup> The severity of drought can be aggravated by other climatic factors, such as prolonged high winds, low relative humidity, and higher temperatures<sup>18</sup>.

Drought is a complex natural hazard defined by lack of precipitation, streamflow, soil moisture, or socioeconomic conditions:

- Meteorological – drought is defined solely by the degree of dryness, expressed as a departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales.
- Hydrological – drought is related to the effects of precipitation shortfalls on streamflows and reservoir, lake, and groundwater levels.
- Agricultural – drought is defined principally in terms of naturally occurring soil moisture deficiencies relative to water demands of plant life, usually arid crops, leading to desiccation in vegetation.
- Socioeconomic – drought associates the supply and demand of economic goods or services with meteorological, hydrologic, and agricultural elements. Socioeconomic drought occurs when the water demand exceeds the supply due to a weather-related shortfall. It may also be called a water management drought.

A drought's severity depends on numerous factors, including duration, intensity, and geographic extent, as well as regional water supply demands by humans and vegetation. Due to its multi-dimensional nature, drought is difficult to define in exact terms and poses difficulties regarding comprehensive risk assessments.

Drought differs from other natural hazards in three ways. First, the onset and end of a drought are difficult to determine due to the slow accumulation and lingering effects of an event after its apparent end. Second, the lack of an exact and universally accepted definition adds to the confusion about its existence and severity. Third, in contrast with other natural hazards, the impact of drought is less obvious and may be spread over a larger geographic area. These characteristics have hindered many governments' preparation of drought contingency or mitigation plans.

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<sup>17</sup> Federal Emergency Management Agency. (2022). *FEMA National Risk Index*. Retrieved September 14, 2022, from Drought: <https://hazards.fema.gov/nri/drought>

<sup>18</sup> Federal Emergency Management Agency. (1997). *Homeland Security Digital Library*. Retrieved from Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy: <https://www.hsd.org/?abstract&did=481396>

Droughts may cause a water shortage for human and industrial consumption, hydroelectric power, recreation, and water-body navigation. Water quality may also decline, and the number and severity of wildfires may increase. Severe droughts may result in the loss of crops and forest products, undernourished wildlife and livestock, lower land values, and higher unemployment.

## History

According to the 2021 Arizona Drought Preparedness Annual Report, drought conditions have been prevalent since the mid-'90s across Arizona. A drought emergency declaration has been in effect since 1999<sup>19</sup>. Many reservoirs in Arizona are often below capacity volumes<sup>20</sup>. Figure 5.4 depicts Arizona reservoir volumes for the end of May 2022 as a percent of capacity. The table lists current and maximum storage and the change in storage from the prior month.

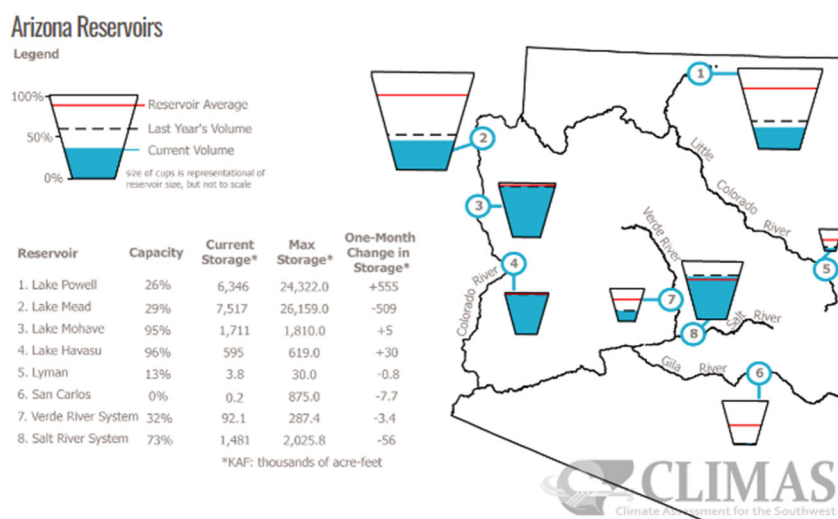


Figure 5.4. Southwest Climate Outlook Arizona Reservoirs

Source: <https://climas.arizona.edu/swco/southwest-climate-outlook-june-2022/arizona-reservoirs>

In 2021 alone, eight disaster designations were issued by the U.S. Department of Agriculture. The Arizona State Climate Office reports that we are in the 27<sup>th</sup> year of a long-term drought. Drought is not foreign to western states, and a single dry year does not constitute a drought since Arizona is a semi-arid to arid climate, but wet years have been sparse recently. Figure 5.5 shows the current Drought in Arizona dashboard report produced by the Arizona Department of Water Resources. The report indicates that average yearly drought levels for Cochise County since 2000 have largely averaged Moderate (D1) to Severe (D2) drought for the State.

<sup>19</sup> Arizona Department of Water Resources. (2022, September 22). *Drought Monitoring Technical Committee*. Retrieved from <https://new.azwater.gov/drought/mt>

<sup>20</sup> National Oceanic and Atmospheric Agency. (2022, June). *SW Climate Outlook: Arizona Reservoirs*. Retrieved October 8, 2022, from CLIMAS: <https://climas.arizona.edu/swco/southwest-climate-outlook-june-2022/arizona-reservoirs>

Between 1849 and 1905, the most prolonged period of drought conditions in 300 years occurred in Arizona. Another prolonged drought occurred during the period from 1941 to 1965. As part of its arid and semi-arid climate, Arizona also experiences anomalously wet periods, including the period from 1978-1988. The long-term average annual statewide precipitation (period of record 1895-2021) is 12.26 inches. Since 1989, statewide yearly precipitation has decreased by 0.55 inches per decade, and only nine years have received above the long-term average annual statewide precipitation since 1994. (Jacobs & Morehouse, 2003) According to the State Climatologist's Office, 20 of the last 29 years have reported deficits from the average water year precipitation.<sup>21</sup>

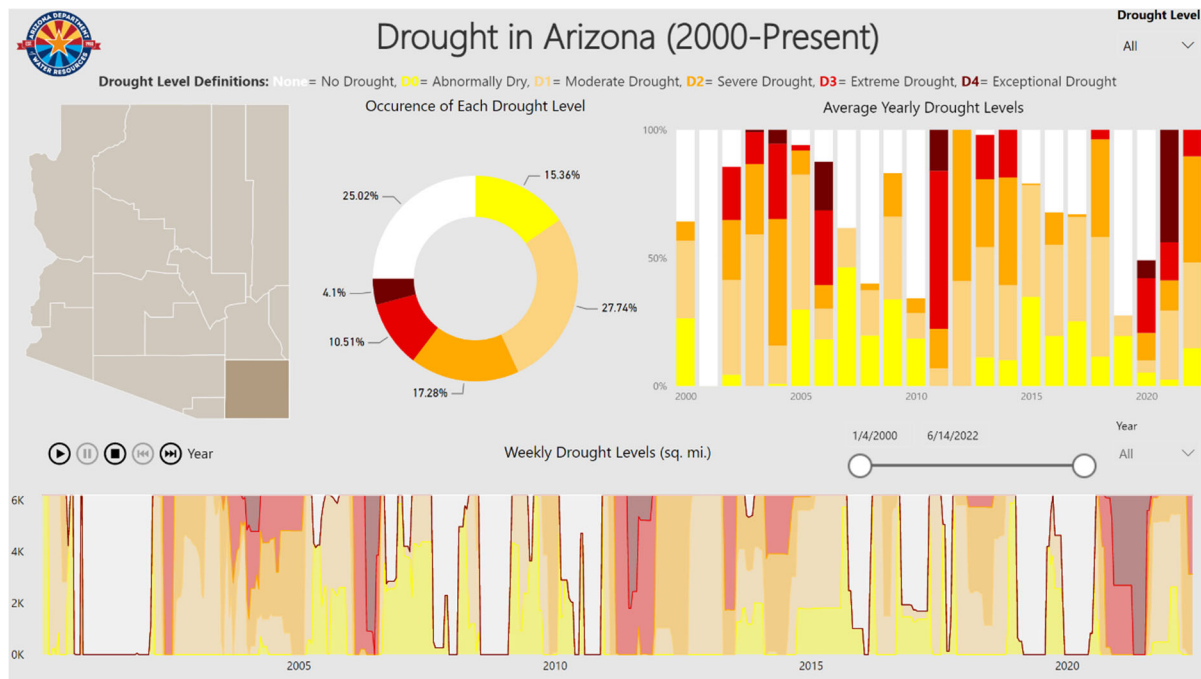


Figure 5.5. Drought in Arizona Dashboard Report (2000-2022) for Cochise County

Source: <https://new.azwater.gov/drought/drought-dashboard>

The 12-month cumulative precipitation values for the County are depicted in Figure 5.6. Since 1900, there have been several periods of lower-than-average rainfall, the last being from May 2020 to April 2021, with 7 inches. Several other periods of low precipitation are identifiable on the chart.

<sup>21</sup> Arizona Department of Water Resources. (2022). *Drought Interagency Coordinating Group*. Retrieved September 22, 2022, from <https://new.azwater.gov/drought/interagency-coordinating-group>



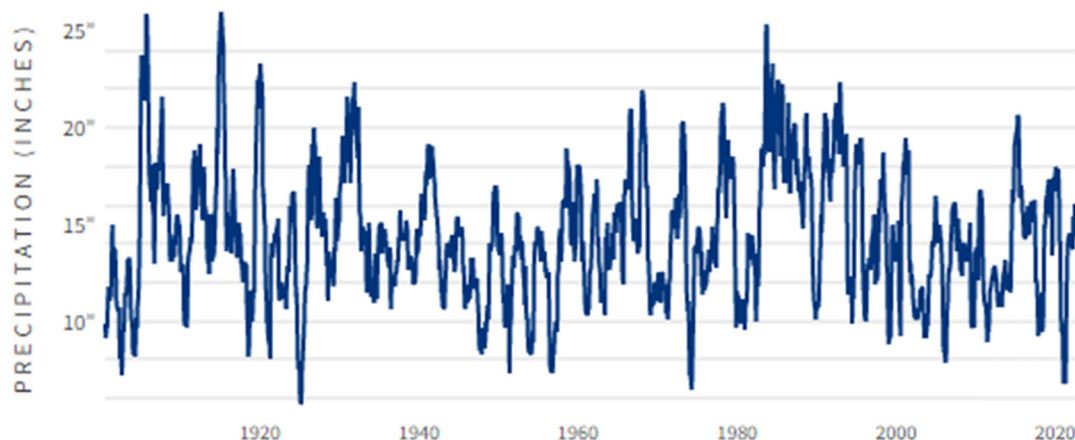


Figure 5.6. USA Facts 12-month Precipitation Values in Cochise County

Source: <https://usafacts.org/issues/climate/state/arizona/county/cochise-county>

### Probability and Magnitude

There is no commonly accepted return period or non-exceedance probability for defining the risk from drought (such as the 100-year or 1% annual chance of flood). The magnitude of drought is usually measured in time and the severity of the hydrologic deficit. Several resources are available to evaluate drought status and projected conditions for the near future.

The National Integrated Drought Information System (NIDIS) Act of 2006 (Public Law 109-430) prescribes an interagency approach for drought monitoring, forecasting, and early warning (space deleted). The act has been reauthorized several times, the most recent being in 2018. The NIDIS's functions are to provide an early drought warning system, build upon forecasting and assessment projects and partnerships, and continue research and monitoring activities. The NIDIS coordinates and consults with "federal, regional, state, tribal, and local government agencies, research institutions, and the private sector" as stakeholders in drought issues. They maintain the US Drought Portal at [www.drought.gov](http://www.drought.gov). The portal houses several drought-related products<sup>22</sup>.

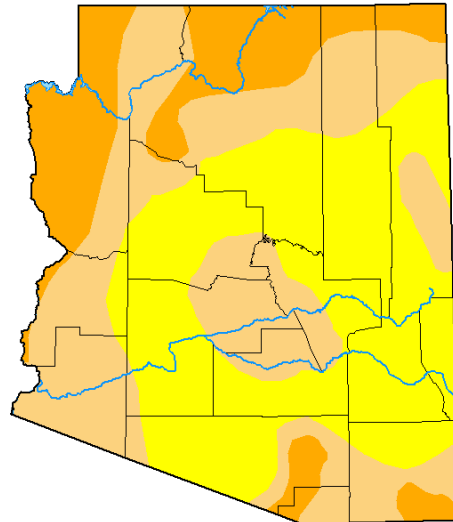
The U.S. Drought Monitor (USDM) provides a weekly map (Figure 5.7) with updated drought locations and intensities. Figure 5.8 breaks down the intensity ratings for the same weekly report. Currently, 63.55% of Cochise County is in moderate drought conditions, and 16.24% is in severe drought conditions.<sup>23</sup>

<sup>22</sup> National Oceanic and Atmospheric Agency. (n.d.). *National Integrated Drought Information System*. Retrieved 2022, from <https://www.drought.gov/about>

<sup>23</sup> Climate Prediction Center/National Oceanic and Atmospheric Agency. (2022, October 4). US Drought Monitor Arizona. Retrieved October 9, 2022, from [https://droughtmonitor.unl.edu/data/png/20221004/20221004\\_az\\_text.png](https://droughtmonitor.unl.edu/data/png/20221004/20221004_az_text.png)

**U.S. Drought Monitor**  
**Arizona**

**October 4, 2022**  
(Released Thursday, Oct. 6, 2022)  
Valid 8 a.m. EDT



**Intensity:**

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>*

**Author:**

Brad Pugh  
CPC/NOAA



[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

Figure 5.7. U.S. Drought Monitor Map for October 4, 2022

Source: [https://droughtmonitor.unl.edu/data/png/20221004/20221004\\_az\\_text.png](https://droughtmonitor.unl.edu/data/png/20221004/20221004_az_text.png)



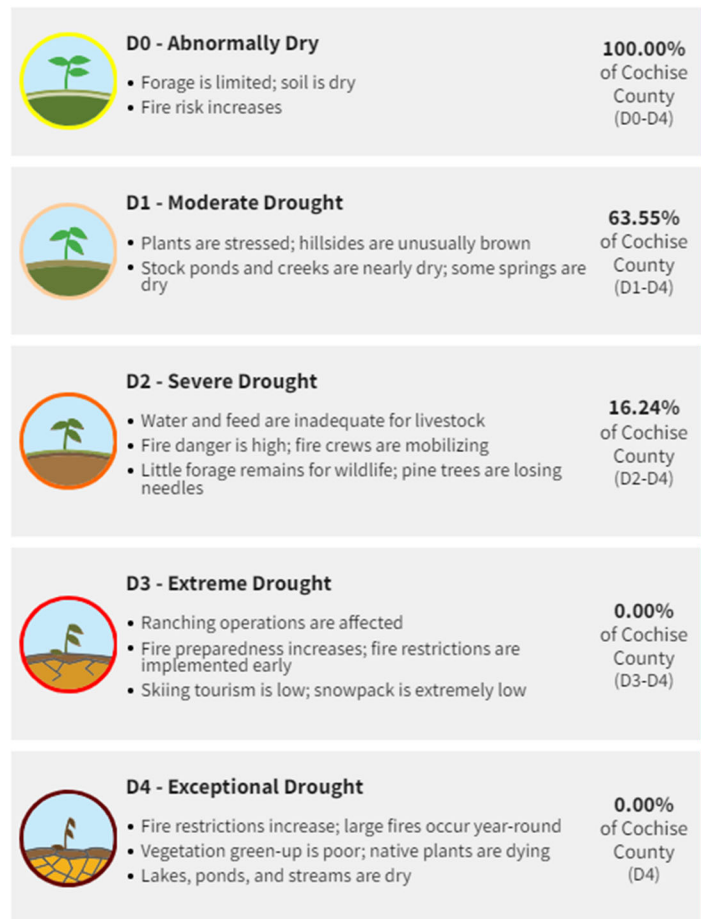


Figure 5.8. U.S. Drought Monitor Map Condition Percentages for October 4, 2022

Source: <https://www.drought.gov/states/arizona/county/cochise>

In 2003, Governor Janet Napolitano created the Arizona Drought Task Force (ADTF), led by ADWR, which developed a statewide drought plan. The plan includes criteria for determining short- and long-term drought status for each of the 15 major watersheds in the State using assessments that are based on precipitation and stream flow. The plan also provides the framework for several interagency groups to inform and coordinate drought activities statewide. The State Drought Monitoring Technical Committee<sup>24</sup> reports to the Governor twice a year on the drought status and the potential need for drought declarations. The State also maintains a Drought Interagency Coordinating Group to advise the Governor and coordinate and integrate drought planning and management in Arizona.<sup>25</sup>

<sup>24</sup> Arizona Department of Water Resources. (2022, September 22). *Drought Monitoring Technical Committee*. Retrieved from <https://new.azwater.gov/drought/mtc>

<sup>25</sup> Arizona Department of Water Resources. (2016). *Arizona Drought Interagency Coordinating Group*. Retrieved September 22, 2022, from <https://infoshare.azwater.gov/docushare/dsweb/Get/Document-9990/ICG%20Fact%20Sheet%202016.pdf>

The counties use the monthly drought status reports to implement drought actions within their plans. Figure 5.9 is the Monthly Drought Status Summary for August 2022. As of this report, the summer monsoon was productive for most of Arizona, improving short-term drought conditions, but the long-term remains in persistent drought.

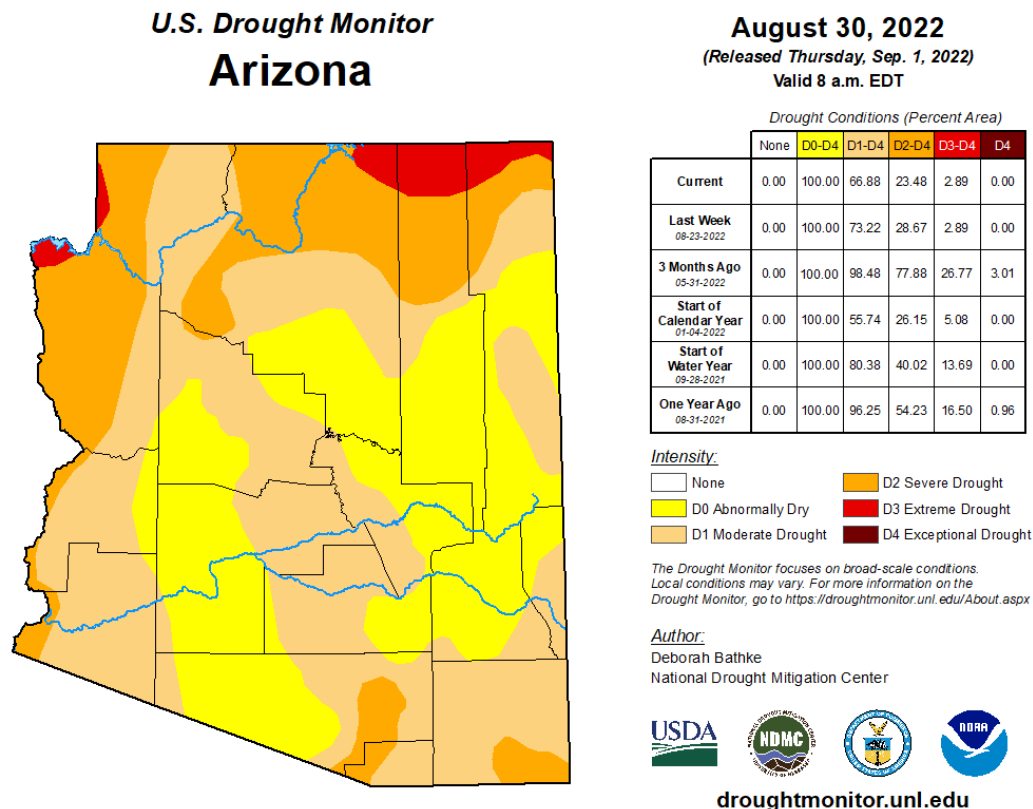


Figure 5.9. Arizona Short-Term Drought Status Map  
Source: <https://new.azwater.gov/drought/drought-status>

The USDM also offers a monthly Seasonal Drought Outlook (Figure 5.10) showing current drought status changes predicted over the next three months. Most of southeastern Arizona remains in the persistent drought category. National Current Conditions are available at [www.drought.gov/current-conditions](http://www.drought.gov/current-conditions). The Arizona long-term drought status map (Figure 5.8) shows more favorable conditions for southeastern Arizona than other areas.

# **U.S. Seasonal Drought Outlook** Drought Tendency During the Valid Period

Valid for October 1 - December 31, 2022  
Released September 30, 2022

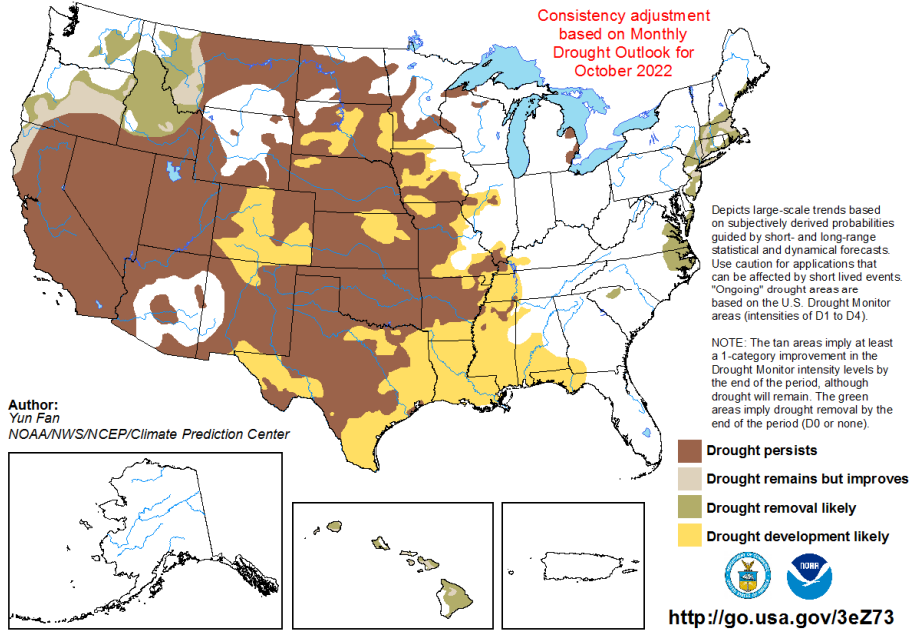


Figure 5.10.U.S. Seasonal Drought Outlook

Source:

[https://www.cpc.ncep.noaa.gov/products/expert\\_assessment/season\\_drought.png](https://www.cpc.ncep.noaa.gov/products/expert_assessment/season_drought.png)

The following Figure 5.11 is the most recent long-term drought map available as of the writing of this plan.

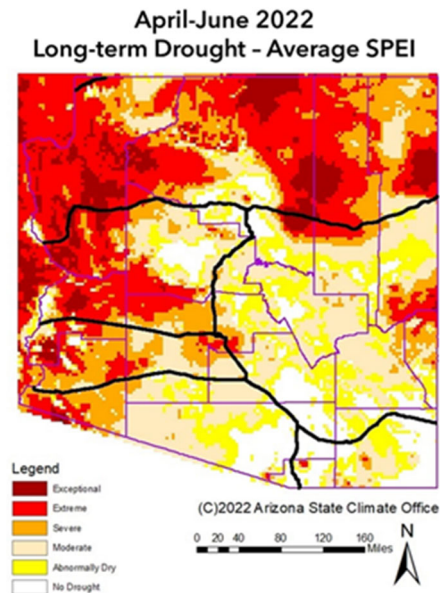


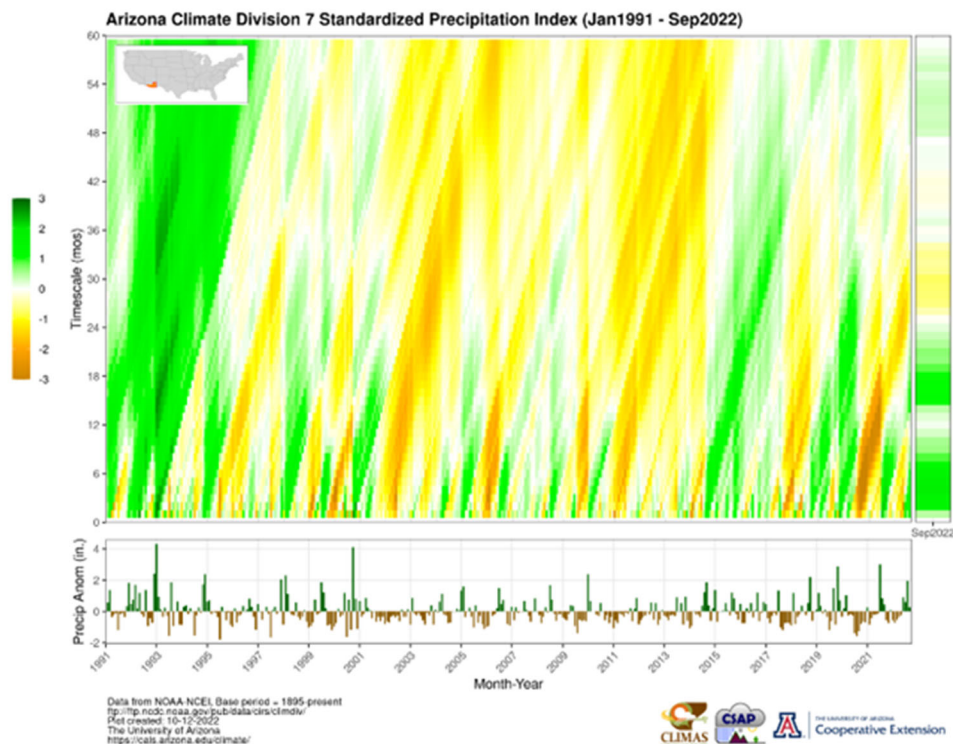
Figure 5.11. Arizona Long-Term Drought Status Map

Source: <https://new.azwater.gov/drought/drought-status>

The State Drought Monitoring Technical Committee uses the Standardized Precipitation Index (SPI) for the short-term drought status and a combination of the SPI and streamflow for the long-term drought status. Figure 5.12 is the SPI for Southeastern Arizona, including Cochise County. The greens are wetter than average, and the yellows and browns are drier than average timeframes.

Most of the domestic water for Cochise County is supplied by wells that tap into various groundwater sources. Some private wells' primary water sources are small, shallow microbasins heavily dependent on rainfall and runoff. These microbasins can be rapidly over-drafted during drought, leaving some wells dry or significantly impaired. Deeper aquifers are impacted by drought through the reduction of surface waters flowing in the perennial streams and cienegas, a wetland system unique to the southwest, and a general lowering of the groundwater table. Conditions are compounded when more demand is placed on these aquifers once the shallower microbasins dry up.

In areas such as the San Pedro River Valley, lowering of the groundwater due to drought and increased domestic demands also impacts the ecology of the riparian corridor. The following are examples of the impacts reported.<sup>26</sup> Another significant impact that is believed to be strongly influenced by drought is the formation of giant desiccation cracks (GDC) within the County. Cochise



County has chosen Fissures as a risk and hazard for this plan.

Figure 5.12. Standardized Precipitation Index for Southeastern Arizona

Source: [https://cals.arizona.edu/climate/misc/spi/spi\\_contour.html](https://cals.arizona.edu/climate/misc/spi/spi_contour.html)

<sup>26</sup> Jacobs, K. L., Garfin, G. M., & Morehouse, B. J. (n.d.). Climate Science and Drought Planning: The Arizona Experience. *Journal of the American Water Resources Association*.

## Extent

As mentioned, the extent of the risks of sustained drought is broad and felt mostly in certain sectors such as agriculture, water supply, and recreation. Sustained drought conditions will impact other hazards such as fissures, flooding, subsidence, and wildfire. Extended drought may weaken and dry the grasses, shrubs, and trees of wildfire areas, making them more susceptible to ignition. Drought also tends to reduce the vegetative cover in watersheds, decreasing the interception of rainfall and increasing the flooding hazard. Subsidence and fissure conditions are aggravated when lean surface water supplies force the pumping of more groundwater to supply the demand without the benefit of recharge from normal rainfall.

## Vulnerability – CPRI Results

Drought CPRI results for each community are summarized in the following table.

Table 5.5. CPRI Results by Jurisdiction for Drought					
Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Benson	3.00	2.00	1.00	3.50	2.45
Bisbee	4.00	3.00	1.00	4.00	3.25
Douglas	4.00	3.00	1.00	4.00	3.25
Huachuca City	3.00	3.20	1.00	4.00	2.86
Sierra Vista	4.00	2.00	1.00	4.00	2.95
Tombstone	2.00	1.00	1.00	3.00	1.65
Willcox	2.50	1.00	0.25	0.25	1.49
Unincorporated County	3.50	2.50	1.00	4.00	2.88
County-wide average CPRI =					2.62

According to the CPRI results above, Bisbee, Douglas, Sierra Vista, Huachuca City, and unincorporated Cochise County rated drought highly. Drought is the highest-scored hazard in the National Risk Index Database at 59.4 for Cochise County.<sup>27</sup>

Most areas of the County have been under varying degrees of drought conditions for the last 20 years plus. Multiple jurisdictions were concerned about the increased risk of wildfires in the forested, grassland, and urban interface areas around their communities.

<sup>27</sup> Federal Emergency Management Agency. (2022). *FEMA National Risk Index*. Retrieved September 14, 2022, from Drought: <https://hazards.fema.gov/nri/drought>

### Vulnerability – Loss Estimations

No standardized methodology exists for estimating losses due to drought, and drought does not generally directly impact critical and non-critical facilities and building stock. A direct correlation to loss of human life due to drought is improbable for Cochise County. Instead, drought vulnerability is primarily measured by its potential impact on specific sectors of the County economy and natural resources, including:

- Crop and livestock agriculture
- Municipal and industrial water supply
- Recreation/tourism
- Wildlife and wildlife habitat

From 1995 to 2020, Cochise County farmers and ranchers received \$20.1 million in disaster-related assistance funding from the USDA for crop and livestock damages.<sup>28</sup> According to the same database, \$895 thousand was paid in 2018, which is the high for 2015-2020.

The National Risk Index has expected annual losses for drought at \$22 million with an exposure of \$0.11 billion.

Estimates of economic losses incurred by public and private entities having to adjust or compensate for drought-related domestic water supply shortages are difficult to estimate. The University of Arizona has performed an urban water sensitivity analysis for various areas in Arizona through the Climate Assessment Project for the Southwest (CLIMAS). According to one of the CLIMAS documents, domestic and agricultural water use during drought will increase reliance upon non-renewable groundwater by 30 to 50%. The implications of a sustained aquifer overdraft at these rates would be significant, resulting in increased pumping costs and negative impacts on the San Pedro River riparian ecosystem.<sup>29</sup>

CLIMAS also completed a study<sup>30</sup> on the vulnerability of the farming sector to climate, specifically in the Sulphur Springs Valley in northern Cochise and southern Graham counties. The report specifically calls out the vulnerability of the areas in Cochise County since Cochise ranks third of the State's counties in agriculture production.

Other direct costs, such as increased pumping costs due to the lowering of groundwater levels and costs to expand water infrastructure to compensate for reduced yields or develop alternative water sources, are significant but very difficult to estimate due to a lack of documentation. There

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<sup>28</sup> Environmental Working Group. (2020). *Farm Subsidy Database*. Retrieved September 23, 2022, from Arizona Farm Subsidy Information: <https://farm.ewg.org/region.php?fips=04000&progcode=total>

<sup>29</sup> Carter, R. H., Tschakert, P., & Morehouse, B. J. (2000). *Assessing the Sensitivity of the Southwest's Urban Water Sector to Climate Variability: Case Studies in Arizona*. Tucson: University of Arizona. Retrieved September 23, 2022, from [https://prism.lib.asu.edu/flysystem/fedora/c16/59882/2000\\_CL1-00.pdf](https://prism.lib.asu.edu/flysystem/fedora/c16/59882/2000_CL1-00.pdf)

<sup>30</sup> Vasquez-Leon, M., West, C. T., Wolf, B., Moody, J., & Finan, T. J. (2002). *Vulnerability to Climate Variability in the Farming Sector: A Case Study of Groundwater-Dependent Agriculture in Southeastern Arizona*. The University of Arizona. Tucson: The Climate Assessment Project for the Southwest (CLIMAS). Retrieved October 10, 2022, from [https://www.academia.edu/73543578/Vulnerability\\_to\\_Climate\\_Variability\\_in\\_the\\_Farming\\_Sector](https://www.academia.edu/73543578/Vulnerability_to_Climate_Variability_in_the_Farming_Sector)

are also intangible costs associated with lost tourism revenues and impacts on wildlife habitat and animals. Typically, these impacts are translated into the general economy in the form of higher food and agricultural goods prices and increased utility costs.

The City of Douglas has 12 wells, six of which are active and six that are inactive. Three of the six active wells are low-level and have been rehabbed or deepened. One of the six inactive wells was abandoned after going dry (377 ft depth), and two were disconnected due to air and sand (500 ft depth). Numerous residents in the unincorporated areas outside of town have been reduced to hauling City supplied water as their wells are dry or otherwise unable to meet their needs. The costs of these efforts were not provided but should be considered.

Huachuca City has seen an increase in wildland fires due to drought conditions and fear that it will get worse. They are focusing their efforts on Firewise and conservation efforts.

#### Vulnerability – Development Trends

Any future population growth will require additional surface and groundwater to meet the demands of potable, landscape, and industrial uses. It is unlikely that significant change will occur in the ranching and farming sectors, given the continued constraints on water rights, grazing rights, and available range land.

Drought planning should be critical to domestic water system expansion or land development. The Arizona Drought Task Force is also working cooperatively with water providers within the State to develop System Water Plans that are comprised of three components:

- *Water Supply Plan* – describes the service area, transmission facilities, monthly system production data, historical demand for the past five years, and projected demands for the next five, 10, and 20 years.
- *Drought Preparedness Plan* – includes drought and emergency response strategies, a plan of action to respond to water shortage conditions, and provisions to educate and inform the public.
- *Water Conservation Plan* – addresses measures to control lost and unaccounted-for water, considers water rate structures that encourage efficient water use, and plans for public information and education programs on water conservation.

The combination of these requirements will work to ensure that future development in Cochise County will recognize drought as a potential constraint.

The City of Benson works with developers to ensure adequate water supply sources and create Firewise communities to reduce their vulnerability to drought's direct and indirect threats.

In Douglas, the Designation of Adequate Water Supply report to the Arizona Department of Water Resources was filed in March 2022. The City projects water demand to increase from 3,000 acre-feet in 2022 to 3,913 acre-feet by 2031. The town completed a water resiliency study, two wells are currently under design/construction, and one additional well is planned for the next year.

Sierra Vista feels that severe and prolonged drought impacts groundwater levels, affecting their drinking water availability. Currently, water supplies are sufficient to sustain the area's population. However, persistent drought conditions will lead to increased stress on the aquifer. Further

development needs to take water supplies into account. In addition, drought increases the potential for other risks, such as wildfires.

Tombstone felt their water supply to be adequate as agriculture and development in the area are limited.

Willcox felt that additional development in the area and continued drought could affect their water supply vulnerability. They are working with the local community, conservation groups, and residences on water conservation efforts to help mitigate the effects of drought on their communities.

### 5.3.3 *Earthquake*

#### Description

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock, usually within the upper 10 – 20 miles of the earth's crust. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of people, and disrupt the social and economic functioning of the affected area. The failure and collapse of structures cause most property damage and earthquake-related death due to ground shaking, depending on the earthquake's amplitude and duration.<sup>31</sup>

#### *Earthquake Mechanics*

Regardless of the source of the earthquake, the associated energy travels in waves radiating outward from the point of release. When these waves travel along the surface, the ground shakes and rolls, fractures form, and water waves may be generated. Earthquakes generally last a matter of seconds, but the waves may travel for long distances and cause damage well after the initial shaking at the point of origin has subsided.

Breaks in the crust associated with seismic activity are known as "faults" and are classified as either active or inactive. Faults may be expressed on the surface by sharp cliffs or scarps or may be buried below surface deposits. "Foreshocks," minor releases of pressure or slippage, may occur months or minutes before the actual onset of the earthquake. "Aftershocks," which range from minor to major, may occur for months after the main quake. In some cases, strong aftershocks may cause significant additional damage, especially if the initial earthquake impacted emergency management and response functions or weakened structures.

#### *Factors Contributing to Damage*

The damage associated with each earthquake is subject to four primary variables:

- The nature of the seismic activity
- The composition of the underlying geology and soils

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<sup>31</sup> Federal Emergency Management Agency. (1997). *Homeland Security Digital Library*. Retrieved from Multi-Hazard Identification and Risk Assessment: A Cornerstone of the National Mitigation Strategy: <https://www.hsdli.org/?abstract&did=481396>



- The level and quality of development of the area struck by the earthquake
- The time of day

*Seismic Activity:* The properties of earthquakes vary significantly from event to event. Some seismic activity is localized (a small point of energy release), while others are widespread (e.g., a major fault shifting or slipping all at once). Earthquakes can be brief (only a few seconds) or last for a minute or more. The depth of release and type of seismic waves generated also play roles in the nature and location of damage; shallow quakes will hit the area close to the epicenter harder but tend to be felt across a smaller region than deep earthquakes.

*Geology and Soils:* An area's surface geology and soils influence seismic waves' propagation (conduction) and how strongly the energy is felt. Generally, stable areas (e.g., solid bedrock) experience less destructive shaking than unstable areas (e.g., fill soils). The siting of a community or even individual buildings plays a strong role in the nature and extent of damage from an event.

*Development:* An earthquake in a densely populated area that results in many deaths and considerable damage may have the same magnitude as a shock in a remote area with no direct impacts. Humans may not even feel large-magnitude earthquakes that occur beneath the oceans.

*Time of Day:* The time of day of an event controls the distribution of an affected area's population. Most of the community will transition between work or school, home, and the commute between the two on work days. The relative seismic vulnerability of each location can strongly influence the loss of life and injury resulting from an event.

### *Types of Damage*

Often, the most dramatic evidence of an earthquake results from the vertical or horizontal displacement of the ground along a fault line. This displacement can sever transportation, energy, utility, and communications infrastructure, potentially impacting numerous systems and persons. These ground displacements can also result in severe and complete damage to structures on top of the ground fault. However, most damage from earthquake events is the result of shaking. Shaking also produces several phenomena that can generate additional damage

- Additional ground displacement
- Landslides and avalanches
- Liquefaction and subsidence
- Seismic Seiches

*Shaking:* During minor earthquakes, objects often fall from shelves, and dishes rattle. In major events, large structures may be torn apart by seismic waves. Structural damage is generally limited to older structures that are poorly maintained, poorly constructed, or improperly (or not) designed for seismic events. Un-reinforced masonry buildings and wood frame homes not anchored to their foundations are typical victims of earthquake damage.

Loose or poorly secured objects also pose a significant hazard when they are loosened or dropped by shaking. These "non-structural falling hazard" objects include bookcases, heavy wall hangings, and building facades. Home water heaters pose a particular risk due to their tendency to start fires when they topple over and rupture gas lines. Crumbling chimneys may also be responsible for injuries and property damage.

Dam and bridge failures are significant risks during more significant earthquake events, and the consequences of such failures may result in considerable property damage and loss of life. In severe seismic shaking hazard, shaking Intensity levels of VII or higher can be experienced even on solid bedrock. In these areas, older buildings especially are at significant risk.

*Ground Displacement:* Ground displacement can also occur due to shaking, resulting in similar damages as mentioned previously.

*Landslides:* Even small earthquake events can cause landslides. Rock falls are common as unstable material on steep slopes is shaken loose, but significant landslides or debris flows can be generated if conditions are ripe. Roads may be blocked by landslide activity, hampering response and recovery operations. Avalanches are possible in areas of large snowfall when the snowpack is sufficient.

*Liquefaction and Subsidence:* Soils may liquefy or subside when impacted by seismic waves. Fill and previously saturated soils are especially at risk. The failure of the soils has the potential to cause widespread structural damage. The oscillation and failure of the soils may result in increased water flow or failure of wells as the subsurface flows are disrupted and sometimes permanently altered. Increased flows may be dramatic, resulting in geyser-like water spouts or flash floods. Similarly, septic systems may be damaged, creating both inconvenience and health concerns.

*Seiches:* Seismic waves may rock an enclosed body of water (e.g., lake or reservoir), creating an oscillating wave referred to as a “seiche.” Although not a common cause of damage in past Arizona earthquakes, there is a potential for significant, forceful waves similar to a tsunami (tidal waves) to be generated on the large reservoirs. Such a wave would be a hazard to shoreline development and pose a significant risk to dam-created reservoirs. A seiche could either overtop or damage a dam leading to downstream flash flooding.

Environmental impacts of earthquakes can be numerous, widespread, and devastating, mainly if indirect consequences are considered, such as:

- Induced flooding and landslides
- Poor water quality
- Damage to vegetation
- Breakage in sewage or toxic material containments

### History

Arizona experiences more earthquakes than most states in the nation. Being in such close proximity to California and Mexico, which both experience a significant amount of earthquakes, increases Arizona’s risk and vulnerability to earthquake hazards. Many tremors are often felt in Cochise County when the epicenter is located in nearby Mexico.

According to the United State Geological Survey (USGS)<sup>32</sup>, from 1830 to 2022, a total of 18 earthquake epicenters have occurred in Cochise County with a maximum magnitude of 6.9. The

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<sup>32</sup> U.S. Geological Survey. (n.d.). Earthquake Hazards. Retrieved October 14, 2022, from <https://www.usgs.gov/programs/earthquake-hazards/earthquakes>

largest recorded earthquakes in Arizona have occurred in San Pedro, San Bernardino, and just north of Flagstaff. The San Pedro event had an epicenter about 25 miles west of Tucson and caused massive damage to built structures.

The southeastern and southwestern corners of the State are where the greatest intensity of earthquakes have occurred. Active faults in Arizona, California, and Mexico have generated large earthquakes that have damaged structures within Arizona's borders. The Sonoran earthquake in 1887 was 7.2 in magnitude and occurred along the Pitaycachi fault in Mexico. The epicenter for this event was located approximately 40 miles south of Douglas, Arizona.

The Town of Duncan in Greenlee County, north of Cochise County, experienced two significant earthquake events in 1939 and again in 2014. Since then, numerous smaller quakes have been reported in the area. Figure 5.13, provided by the Arizona Earthquake Information Center, shows earthquake epicenters and faults in Cochise between 1830 and 2022.

Since the last plan, Douglas has been shaken by several earthquakes.

- In October 2019, a quake was reported south of Douglas that measured 3.9 and 3.5 on the Richter Scale. The epicenter was 25 miles southeast of Douglas.<sup>33</sup>
- In April 2020, the USGS reported a magnitude 3.5 quake that was felt northeast of Douglas.<sup>34</sup>

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<sup>33</sup> Whetten, B. (2019, October 14). Douglas Shaken by Minor Earthquake. *Douglas Dispatch*. Retrieved from [https://www.myheraldreview.com/news/douglas/douglas-shaken-by-minor-earthquake/article\\_76b8e8fe-e596-5fa1-93d1-49a6b84647b8.html](https://www.myheraldreview.com/news/douglas/douglas-shaken-by-minor-earthquake/article_76b8e8fe-e596-5fa1-93d1-49a6b84647b8.html)

<sup>34</sup> 3.5 Earthquake Reported Northeast of Douglas. (2020, April 22). *Douglas Dispatch*. Retrieved from [https://www.myheraldreview.com/news/douglas/3-5-earthquake-reported-northeast-of-douglas/article\\_a49ba33d-2724-5e6e-b9d0-d08ad9205fa9.html](https://www.myheraldreview.com/news/douglas/3-5-earthquake-reported-northeast-of-douglas/article_a49ba33d-2724-5e6e-b9d0-d08ad9205fa9.html)

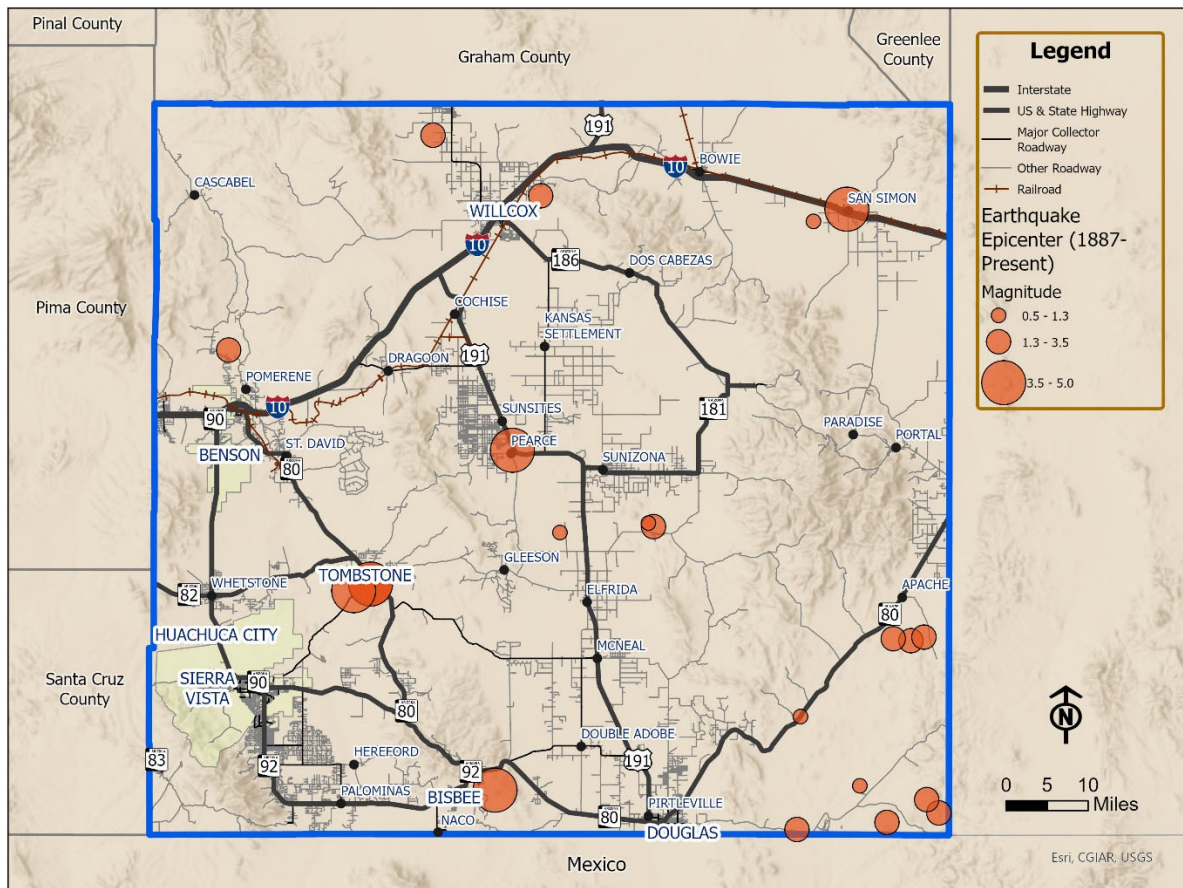


Figure 5.13. Earthquake Epicenters in Cochise County  
Source: [https://aeic.nau.edu/eq\\_fault\\_maps.html](https://aeic.nau.edu/eq_fault_maps.html)

### Probability and Magnitude

Ground motion is the vibration or shaking of the ground during an earthquake caused by the radiation of seismic waves. The vibration severity generally increases with the amount of energy released and decreases with the distance from the causative fault or epicenter of the earthquake. Additional factors, such as soft soils or topographic ridges, can further amplify ground motions. Ground motion causes waves in the earth's interior, also known as seismic waves, and along the earth's surface, known as surface waves. Seismic waves include P (primary) waves and S (secondary) waves. P waves are longitudinal or compressional waves similar in character to sound waves that cause back-and-forth oscillation along the direction of travel (vertical motion), with particle motion in the same direction as wave travel. They move through the earth at approximately 15,000 mph. S (secondary) waves, also known as shear waves, are slower than P waves and cause structures to vibrate from side-to-side (horizontal motion) due to particle motion at right angles to the direction of wave travel. Unreinforced masonry buildings are prone to damage from surface waves.

Seismic activity is commonly described in terms of magnitude and intensity. Magnitude ( $M_w$ ), usually reported as moment magnitude replacing the more well-known Richter scale, measures the total energy released during an earthquake. Intensity ( $I$ ), as expressed by the Modified Mercalli Intensity (MMI) scale, subjectively describes the severity of an earthquake in terms of its effects on the earth's surface and human society. Although an earthquake has only one magnitude, intensity varies by location – proximity to the epicenter, substrate, building styles, and population density, among other factors. Magnitude is the measure of the seismic wave amplitude and is expressed by a logarithmic scale representing the amount of energy released from the fault's movement. An increase in the Magnitude scale by one whole number represents a tenfold increase in the measured amplitude of the earthquake and a 30-fold increase in energy.

Another way to express an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. Peak ground acceleration (PGA) measures the strength of ground movements in this manner. PGA represents the rate of change of motion of the earth's surface during an earthquake as a percent of the established rate of acceleration due to gravity. PGA can be partly determined by what soils and bedrock characteristics exist in the region. Unlike the Richter scale, PGA is not a measure of the total energy released by an earthquake but instead of how hard the earth shakes at a given geographic area (the intensity). Using instruments, including accelerographs, PGA is measured and correlates well with the Mercalli scale.

When the peak ground acceleration nears 0.04 – 0.092g, an earthquake can be felt by people walking outside. The intensity is considered very strong as PGA nears 0.19 – 0.34g. At this level, plaster can break off and fall away from structures, and cracks in walls often occur. PGA magnitudes of 1.24g are considered to be very disastrous. This magnitude of ground acceleration represents an earthquake of roughly 6.9 to 8.1 on the Richter Scale.

The Richter Scale is the most commonly used for measuring earthquake magnitudes and potential impacts. A detailed description of the Modified Mercalli Intensity Scale as it relates to PGA, the Richter Scale, and damage effects is shown in the following table.

Earthquakes are extremely difficult to predict, and their occurrence rate is determined in one of two ways. If geologists can find evidence of distinct, datable earthquakes in the past, the number of these ruptures is used to define an occurrence rate. If evidence is unavailable, geologists estimate fault slip rates from accumulated scarp heights and the estimated date for the oldest movement on the scarp. Because a certain magnitude earthquake is likely to produce a displacement (slip) of a specific size, we can estimate the rate of occurrence of earthquakes of that magnitude.

Recurrence rates are different for different assumed magnitudes thought to be “characteristic” of that fault type. Generally, a more minor magnitude quake will produce a faster recurrence rate and a higher hazard risk for moderate levels of ground motion. Future earthquakes are likely to occur where earthquakes have produced faults in the geologically recent past. Quaternary faults have slipped in the last 1.8 million years, and it is widely accepted that they are the most likely source of future large earthquakes. For this reason, quaternary faults are used to make fault sources for future earthquake models.

Figure 5.14 is a map produced by a study completed by the USGS showing the chance of damage from an earthquake in 2018 compared with the prior 2014 study that did not include Cochise County. This shows the percent chance for the area at less than 1%; however, there is a higher risk area just below Cochise County in Mexico.

## Extent

Cochise County is situated in the Basin and Range Province, characterized by rugged mountain ranges separated by deep sedimentary basins. Rupture of mountain range faults in Arizona's Basin and Range Province is infrequent; however, they do occur and are capable of moment magnitudes of potentially damaging moderate earthquakes. An enhanced continuous GPS network operated by Broermann and others<sup>35</sup> identified an anomalously high strain rate for southwestern Arizona. The authors warn that this magnitude of strain could portend release in one or more rare large-magnitude earthquakes in the future.

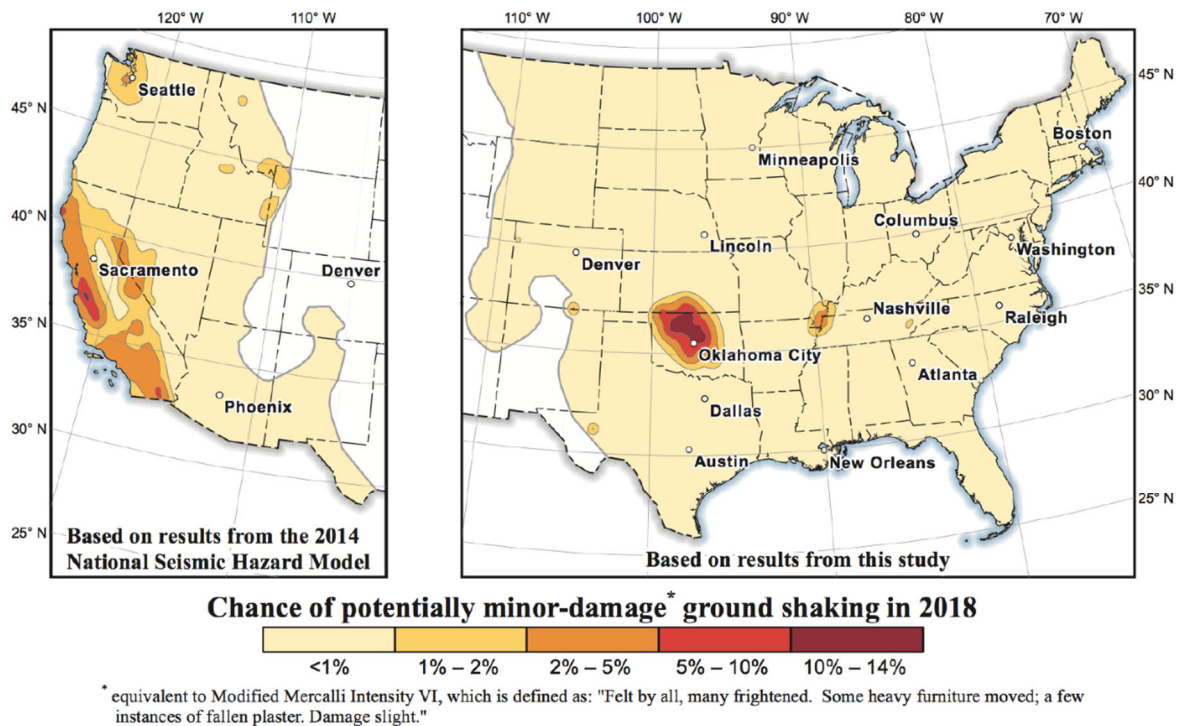


Figure 5.14. USGS Probability of Earthquake Damage Study Results  
Source: <https://www.usgs.gov/programs/earthquake-hazards/science/short-term-induced-seismicity-models>

<sup>35</sup> James, B., Bennett, R. A., Kremer, C., & Pearthree, P. A. (2021, May 14). Geodetic Extension Across the Southern Basin and Range and Colorado Plateau. *Journal of Geophysical Research*, 126(6). Retrieved November 5, 2022, from <https://doi.org/10.1029/2020JB021355>

### Vulnerability – CPRI Results

Earthquake CPRI results for each community are summarized in the following table:

Table 5.6. CPRI Results by Jurisdiction for Earthquake					
Participating Jurisdiction	Probability	Magnitude/Severity	Warning Time	Duration	CPRI Score
Benson	2.00	2.00	3.00	2.00	2.15
Bisbee	2.00	2.50	3.50	2.25	2.40
Douglas	1.00	2.00	4.00	3.00	1.95
Huachuca City	1.50	1.50	4.00	1.00	1.83
Sierra Vista	2.00	1.00	4.00	1.00	1.90
Tombstone	1.00	2.00	4.00	2.00	1.85
Willcox	0.50	0.50	1.00	0.25	0.55
Unincorporated County	2.00	2.25	4.00	2.00	2.38
Countywide average CPRI =					1.84

Based on the CPRI Evaluation, the City of Bisbee and those living or working in Unincorporated Cochise County have the most perceived risk from an earthquake. As shown in the table above, the assumed probability of this event occurring in these two jurisdictions is more likely, and the magnitude of earthquake impacts is thought to be more significant. The National Risk Index for Earthquake for Cochise County is rated “Relatively Low” at 7.8 (Federal Emergency Management Agency, 2022).

### Vulnerability – Loss Estimations

The 2017 plan utilized HAZUS data based on a historical event. During that analysis by the prior consultant, the total building-related losses were expected to be \$3.48 million, 72% sustained by residential structures. The total economic loss for the scenario was estimated to be \$3.74. No significant damages were expected for critical facilities, transportation, or utility lifelines.

Based on information in the National Risk Index<sup>36</sup>, Earthquake has a relatively low score of 7.08 for Cochise County, with an expected annual loss of \$0.53 million and over 1 trillion in exposure. The historical loss ratio is relatively low, however, due to the reasons above. Earthquakes are rare in this area (0.065% chance per year), but losses could be substantial if there is one of significant magnitude.

Further breakdown of the NRI information shows the census tracts with the most vulnerability are the three census tracts running from the north-central part of the County through Wilcox and down

<sup>36</sup> Federal Emergency Management Agency. (2022). National Risk Index. Retrieved July 7, 2022, from <https://hazards.fema.gov/nri/map#>

the State Route 191 corridor. It is assumed that this is due to the ground shaking in the soils of this area. This varies from the participants' CPRI scores.

Benson felt that they could suffer damage to several critical businesses and providers to the community in the event of an earthquake, including a grocery store, hardware store, and hospital. They also have several abandoned residential structures that could sustain damage due to disrepair.

Sierra Vista felt earthquakes in the area are infrequent and low in magnitude. The anticipated impact on assets is minimal and limited to minor non-structural cracking of structures.

Most structures and infrastructure in Willcox were built between 1880 and 1980, with a few exceptions. Many older homes, commercial structures, and agricultural buildings owned by the City and private parties do not meet current building standards. Willcox currently requires new construction to meet the 2003 ICB standards, which do not account for new safety technologies to be deployed during construction. An earthquake with an epicenter in or near Willcox would be catastrophic, resulting in billions of dollars in damages. The town is going to review its building codes as a mitigation action.

#### Vulnerability – Development Trends

It is reasonable to expect future earthquakes in or near Cochise County. Earthquakes strike with little to no warning and can have multiple impacts on an area. After-effects from an earthquake can include impacted roadways, downed power and communication lines, fires, and damaged structures--especially poorly built or those already in disrepair. Earthquakes are not seasonal and thus can be experienced year-round. This fact presents its own set of planning and preparedness concerns.

Standard building codes can provide the planning area with helpful guidance for development throughout unincorporated and incorporated areas. Developers, contractors, and builders should know applicable codes and regulations to reduce losses sustained by new and existing construction due to seismic hazards. As development grows in the planning area, it will be necessary for citizens to consult with local building codes, as modern building codes generally require seismic design elements for new construction.

Any increase in development increases the risk to the planning area from the threat of earthquakes. As population and growth continue to expand in the planning area, continued enforcement of the unified construction code has excellent potential to mitigate increasing vulnerability and development pressure. The Planning Team participants perceived the risk mainly in areas with historical structures not maintained to current building codes



### 5.3.4 Fissure

#### Description

Earth fissures are linear cracks, seams, or separations in the ground surface that extend from the groundwater table or bedrock and are caused by tensional forces related to differential land subsidence, as described in Figure 5.15. In many cases, fissures form as a direct result of subsidence caused by groundwater depletion<sup>37</sup>. The surface expression of fissures ranges from less than a yard to several miles long and from less than an inch to tens of feet wide and tens of feet deep<sup>38</sup>. Earth fissures occur at the edges of intramontane basins, usually parallel to mountain fronts or above local bedrock highs in the subsurface, and typically cut across natural drainage patterns.

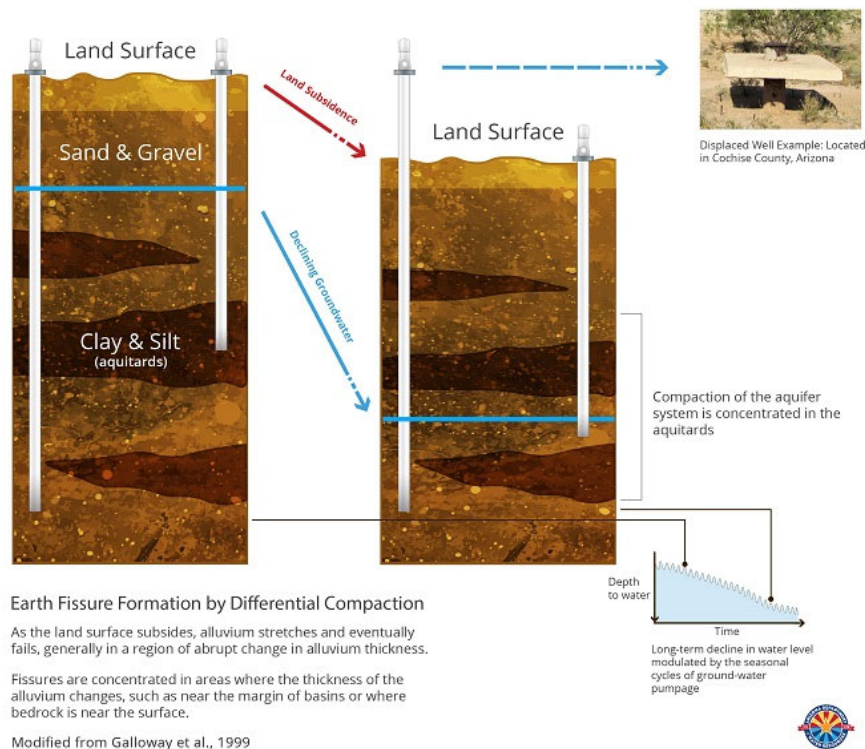


Figure 5.15. Earth Fissure Formation

Source: <https://new.azwater.gov/news/articles/2018-27-06>

Fissures can alter drainage patterns, break buried pipes and lines, cause infrastructure to collapse, provide a direct conduit to the groundwater table for contaminants, and even pose a life safety hazard for humans and animals.

<sup>37</sup> Arizona Department of Water Resources. (2018, June 27). The Latest In Land Subsidence. Retrieved July 17, 2022, from <https://new.azwater.gov/news/articles/2018-27-06>

<sup>38</sup> Slaff, S. (1993). *Land Subsidence and Earth Fissures in Arizona*. Tucson: Arizona Geological Survey. Retrieved July 19, 2022, from [http://repository.azgs.az.gov/uri\\_gin/azgs/dlio/1713](http://repository.azgs.az.gov/uri_gin/azgs/dlio/1713)

## History

In Arizona, fissures were first noted near Picacho in Pinal County in 1927. Fissures have increased dramatically since the 1950s due to accelerated groundwater pumping. Initially, the heaviest use of groundwater was for agricultural irrigation. Population growth has increased domestic demands; however, the watering of farm crops remains the most significant threat. The hazards posed by earth fissures increase as the population expands into the outlying basin edges and mountain fronts, where fissures are more likely to manifest. Most Cochise County fissures occur in the basin interior and around buried bedrock highs.

Several fissure case histories documented by the Arizona Geological Survey (AZGS) for the Cochise County area are summarized below and in Figures 5.18 through 5.24.

The area south of Kansas Settlement to Birch Road

- Over 720 fissure segments
  - 323 continuous earth fissures totaling 47,683 feet.
  - 394 discontinuous earth fissures totaling 50,797 feet
  - Three reported, unconfirmed earth fissures totaling 1,537 feet

The area south of the unincorporated community of Cochise to Dragoon Road

- At least 221 fissure segments totaling 30,832 feet.
  - 119 continuous earth fissures totaling 13,499 feet.
  - 93 discontinuous earth fissures totaling 7,323 feet.
  - Nine reported unconfirmed earth fissures totaling 10,010 feet.

In August of 2011, an earth fissure in an area west of 191 grew considerably. Between August 5th and August 19th of that year, the east segment extended another 239 feet, concerning residents. This earth continues to grow with monsoon rains. Cracks range from six to eight feet deep and, in some areas, six to eight feet wide. It is at least one-quarter mile long and a minimum of three feet wide. Cracks have become progressively worse over time. As with any fissure activity, there is a concern that underground transmission or conveyance lines may become compromised. Emergency vehicle access can be hindered as well.

In the summer of 2018, Cochise Stronghold Road and Dragoon Road were damaged by the reactivation of fissures that had been previously repaired, according to the AZGS.<sup>39</sup> See Figure 5.16.

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<sup>39</sup> Cook, J. (2018). *Road damaged by earth fissure, Cochise County*. Arizona Geological Survey. Tucson: The University of Arizona. Retrieved October 10, 2022, from <https://azgs.arizona.edu/photo/road-damaged-earth-fissure-cochise-county>



Figure 5.16. Earth Fissure Formation Cochise Stronghold Road

Source: <https://azgs.arizona.edu/photo/road-damaged-earth-fissure-cochise-county>

In July 2021, monsoon rains damaged a section of US191 when the ground collapsed along a surface fissure. A recent description of the damage in the Sulphur Springs Valley near 191 describes the damage resulting from coupled earth fissures and giant desiccation cracks (GDCs)<sup>40</sup>. Earth fissures are tension cracks that develop due to land subsidence caused by groundwater withdrawal. GDCs are large surface cracks in soils with certain salts and clays that expand when wet and contract when dry. Repeated wetting and drying of these soils can lead to sizeable polygonal crack networks resembling mudcracks but with polygons hundreds of feet across<sup>41</sup>.

The area surrounding Willcox Playa contains many fissures and GDCs, sometimes colocated. AZGS has suggested that the formation of earth fissures through areas with GDCs can lead to enhanced erosion along GDCs and the deepening of preexisting cracks<sup>42</sup>.

<sup>40</sup> Cook, J. (2021, July 18). U.S. 191 in Cochise County damaged by extensive ground fractures. *Arizona Geology E-magazine*. Retrieved July 19, 2022, from <https://blog.azgs.arizona.edu/blog/2021-07/us-191-cochise-county-damaged-extensive-ground-fractures>

<sup>41</sup> Harris, R. C. (2004). *Giant Desiccation Cracks in Arizona*. Tucson: Arizona Geological Survey. Retrieved July 19, 2022, from [http://repository.azgs.az.gov/uri\\_gin/azgs/dlio/1059](http://repository.azgs.az.gov/uri_gin/azgs/dlio/1059)

<sup>42</sup> Cook, J. (2011). Why Did the Fissure Cross the Road? New and Old Fissure Activity in Cochise County, Arizona. *Arizona Geology*. (M. Conway, Ed.) Tucson. Retrieved July 19, 2022, from [https://azgeology.azgs.arizona.edu/archived\\_issues/azgs.az.gov/arizona\\_geology/spring11/article\\_feature\\_print.html](https://azgeology.azgs.arizona.edu/archived_issues/azgs.az.gov/arizona_geology/spring11/article_feature_print.html)

### Probability/Magnitude

There are no methods of quantifiably predicting the probability and magnitude of earth fissures. The locations of potential fissures or extension of existing fissures may be predictable in specific areas if enough information about the subsurface material properties and groundwater levels is available. It is fair to assume that continued groundwater depletion will result in more earth fissures and the reactivation of existing fissures. The magnitude of existing and new fissures is dependent upon several variables, including the depth to groundwater, type and depth of superficial material present, amount and rate of groundwater depletion, groundwater basin depth, depth to bedrock, volume and rate of runoff due to precipitation entering the fissure, and human intervention.

### Extent

The Arizona Geological Survey has mapped known and suspected fissure lineaments of Cochise County, with the latest update of GIS data having a version date of November 6th, 2019<sup>43</sup>. These locations are indicated on the Maps at the end of this section (Figures 5.18 through 5.24). Four types of earth fissure classifications are depicted. The “Continuous” and “Discontinuous” show two different surface expressions of earth fissures. The “Reported/Unconfirmed” lines represent approximate locations of previously reported but cannot be relocated; therefore, their existence cannot be confirmed for various reasons. The “Confirmed/Unsurveyed” lines represent fissures that need additional evaluations.

### Vulnerability – CPRI Results

Fissure CPRI results for each community are summarized in the following table:

Table 5.7. CPRI Results by Jurisdiction for Fissures					
Participating Jurisdiction	Probability	Magnitude/Severity	Warning Time	Duration	CPRI Score
Benson	2.00	1.00	3.00	2.00	<b>1.85</b>
Bisbee	2.00	2.00	3.25	2.25	<b>2.21</b>
Douglas	2.00	1.00	1.00	4.00	<b>1.75</b>
Huachuca City	1.00	2.00	3.80	2.50	<b>1.87</b>
Sierra Vista	1.00	1.00	1.00	4.00	<b>1.30</b>
Tombstone	2.00	1.00	4.00	2.00	<b>2.00</b>
Willcox	2.00	1.25	0.75	0.25	<b>1.41</b>
Unincorporated County	3.00	2.50	3.50	3.00	<b>2.93</b>
County-wide average CPRI =					<b>1.92</b>

<sup>43</sup> Arizona Geological Survey. (2019). Locations of Mapped Earth Fissure Traces in Arizona v. 06.01.2019. AZGS Document Repository. Tucson. Retrieved July 22, 2022, from [http://repository.azgs.az.gov/uri\\_gin/azgs/dlio/997](http://repository.azgs.az.gov/uri_gin/azgs/dlio/997)

Based on the CPRI Evaluation areas, unincorporated Cochise County is rated higher for fissure risk, which tracks with the location of fissures throughout the County. As demonstrated in the table above, the probability of this event occurring in these two jurisdictions is believed to be more likely, and the magnitude of impacts more significant. This reflects earlier studies on the investigation of Willcox and Douglas Basins<sup>44</sup>.

Fissures have not been observed within the incorporated limits of Sierra Vista. In theory, they could become an issue due to our mountain-front location if groundwater levels decline dramatically. They could damage structures, roadways, and utility systems if they were to appear due to significant cracking and separation. All known fissures within Cochise County have occurred outside the Tombstone City limits. Benson does not have any active fissures, but there are some south of the town toward St. David.

The City of Willcox has experienced three major fissures under the only waterline moving water from the well to the public utility. Fissure incidents in 2018, 2021, and 2022 threatened Willcox's water service requiring emergency repairs and temporary mitigation. A combination of drought conditions with sudden sheet flooding over the desert floor has increased the fissure's number, size, and depth over the past five years.

#### Vulnerability – Loss Estimations

The Arizona Land Subsidence Group (ALSG) prepared a white paper in 2007 that summarizes fissure risk and various case studies (Figure 5.17).<sup>45</sup>

Table 1. Hazards Directly Associated with Earth Fissures	
<ul style="list-style-type: none"> <li>• Cracked or collapsing roads</li> <li>• Broken pipes &amp; utility lines</li> <li>• Damaged or breached canals</li> <li>• Cracked foundation/separated walls</li> <li>• Loss of agricultural land</li> <li>• Livestock &amp; wildlife injury or death</li> </ul>	<ul style="list-style-type: none"> <li>• Severed or deformed railroad track</li> <li>• Damaged well casing or wellhead</li> <li>• Disrupted drainage</li> <li>• Contaminated groundwater aquifer</li> <li>• Sudden discharge of ponded water</li> <li>• Human injury or death</li> </ul>

(After Pewe, 1990; Bell & Price, 1993; and Slaff, 1993)

Figure 5.17. Damages Associated with Earth Fissures

Recorded losses in Cochise County due to fissures primarily involve damages to roadways. Other infrastructures, including pipelines and fiber optics, are near fissures, but no records of damages were noted in the research. According to the ALSG (2007):

*“The problems encountered with subsidence and earth fissures in Arizona will increase as groundwater continues to be withdrawn at unsustainable levels. More damage to structures and infrastructure can be expected with ever-increasing economic losses, and, more importantly, a burgeoning threat to human health and safety, too.”*

<sup>44</sup> Kopnietzki, A. (2006). *Investigation of the Hydrologic Monitoring Network of the Willcox and Douglas Basins of Southeastern Arizona: A Project of the Rural Watershed Initiative*. United States Geological Survey. United States Department of the Interior. Retrieved July 24, 2022, from <https://www.usgs.gov/publications/investigation-hydrologic-monitoring-network-willcox-and-douglas-basins-southeastern>

<sup>45</sup> Arizona Land Subsidence Group. (2007). *Land Subsidence and Earth Fissures in Arizona*. Tucson: Arizona Geological Survey. Retrieved July 20, 2022, from <http://www.azgs.gov/Earth%20Fissures/CR-07-C.pdf>

Estimating potential exposure to fissure risk was accomplished by intersecting the County's parcel data with existing fissure data. The maps at the end of this hazard show these identified fissure locations in the County. All affected parcels are in unincorporated County areas.

There are no commonly accepted methods for estimating potential fissure-related losses, and no loss estimates are included here. FEMA's National Risk Index does not categorize fissure hazards. No critical facilities are predicted to be impacted by fissure lines in Cochise County. The primary vulnerability at this time is where fissure lineaments intersect roadways or other transportation corridors. The vulnerability lies with the road improvements themselves, the safety of travel, and the potential impact on utilities that often share the right-of-way or roadway alignments.

Willcox feels that any service interruption due to fissures around utility services would be catastrophic. After a forced shutdown of the water or natural gas system, restoration would take weeks or months as the City of Willcox public utility is an island serving low to moderate-income residents. Most of the infrastructure, including conveyance systems for gas, water, and wastewater, was built and has been running continuously since the early 1940s. Willcox is seeking funding to update and replace aging utility infrastructure, which will reduce the vulnerability of the systems to fissure damage. The high-pressure nature gas line replacement is estimated at \$9.6 million in construction costs alone. Water infrastructure and wastewater conveyance and treatment costs are calculated over the \$50 million mark.

#### Vulnerability – Development Trends

Several fissures are located in areas with potential development and growth. Most of these impacted areas are within unincorporated areas of the County, but the northern part of Willcox could also be affected. Roadway intersection with the fissures is an ongoing concern for public safety access to vulnerable populations and industries such as Apache Nitrogen Products near the St. David area south of Benson off State Route 80. Monitoring earth fissures and regular roadway maintenance will be ongoing activities in the locations impacted by fissures.

The AZGS<sup>46</sup> uses Interferometric Synthetic Aperture Radar (InSAR) technology to monitor subsidence rates in basins around the state. There has been some slowing in the rate of growth subsidence in some areas thanks to recharge and reduced pumping in several regions. The Arizona Department of Water Resources (ADWR) is partnering with Cochise County to monitor and minimize subsidence vulnerabilities. This data can be taken into account by jurisdictions when approving development in their areas.

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<sup>46</sup> Conway, M. (2017, July 17). That sinking feeling: State-of-art technology at work on Arizona subsidence finds you're not imagining it. *Arizona Geology: Blog of the State Geologist of Arizona*. (A. G. Survey, Ed.) Tucson: Arizona Geological Survey. Retrieved July 22, 2022, from <http://arizonageology.blogspot.com/2017/07/that-sinking-feeling-state-of-art.html>



Figure 5.18. – Fissure Locations Countywide

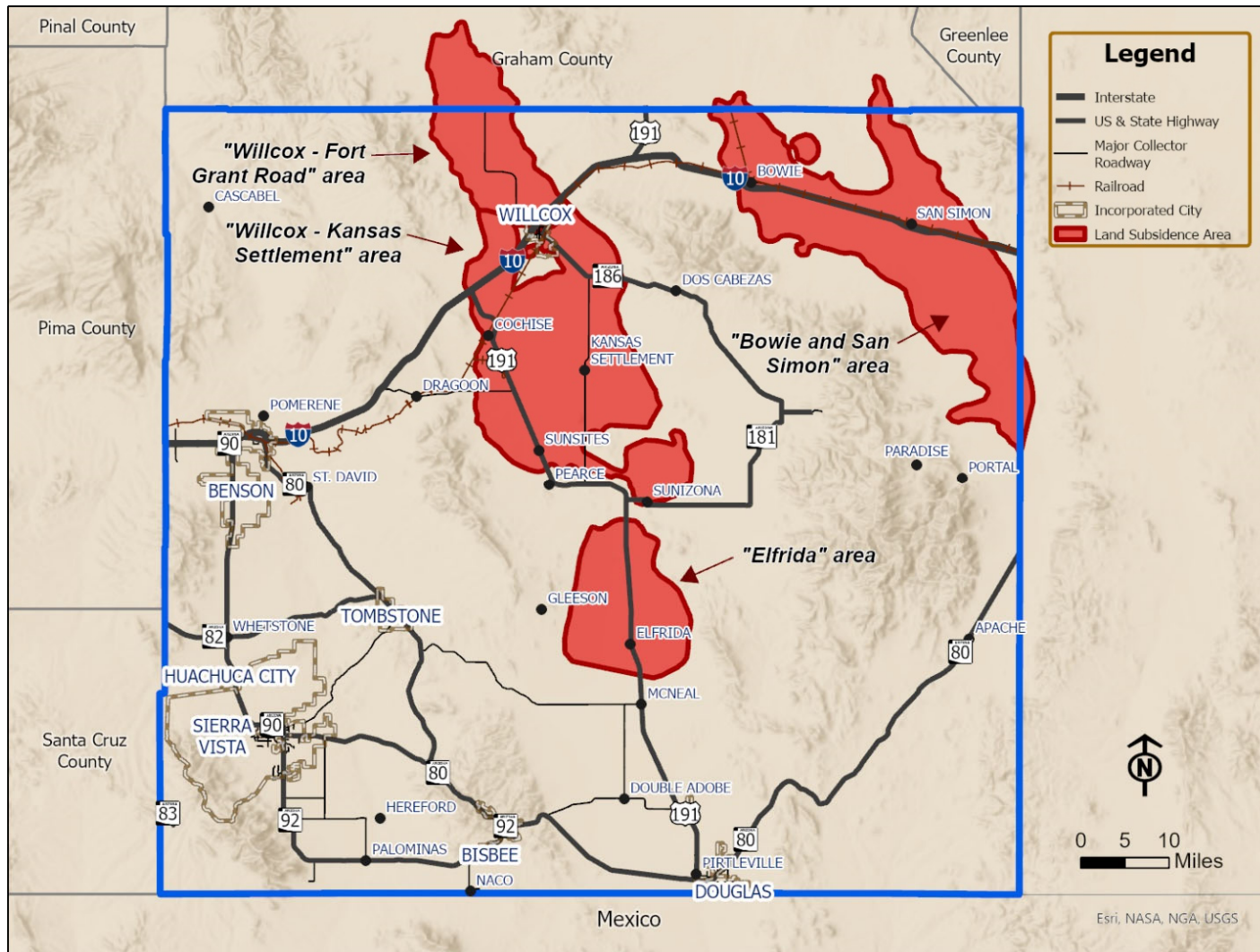


Figure 5.19. – Fissure Locations Bowie/San Simon

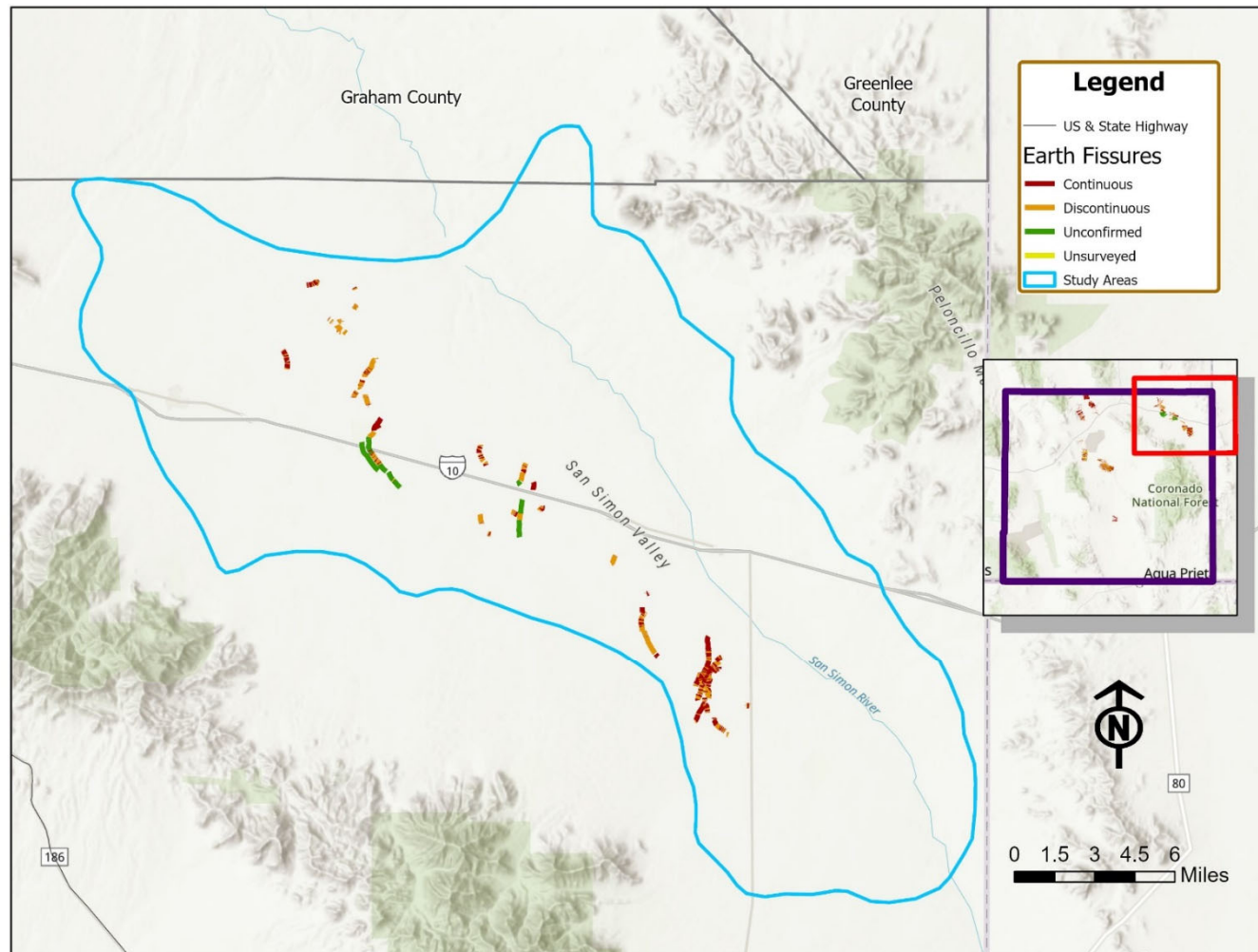




Figure 5.20. – Fissure Locations Croton Springs

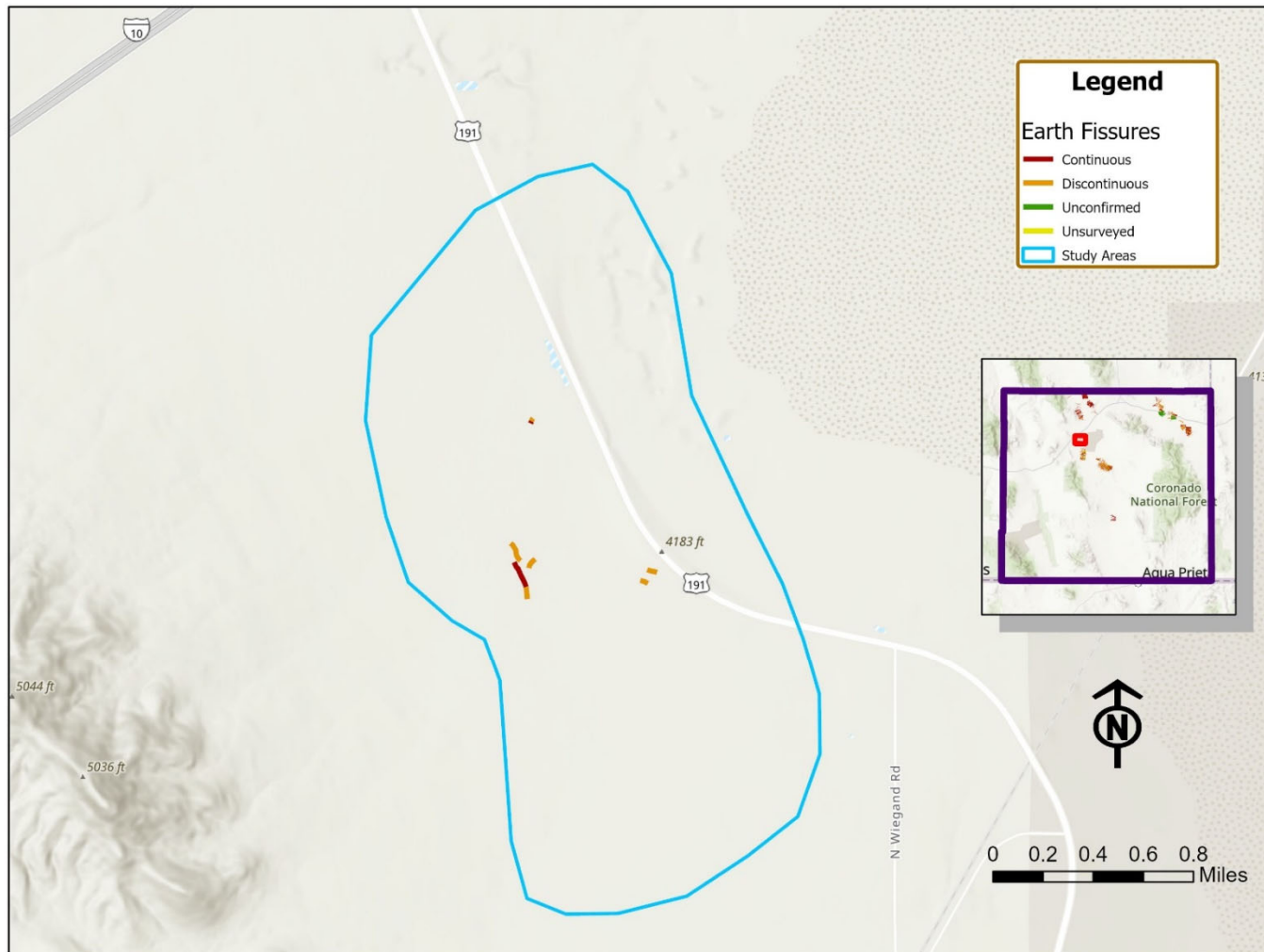


Figure 5.21. – Fissure Locations Dragoon Road

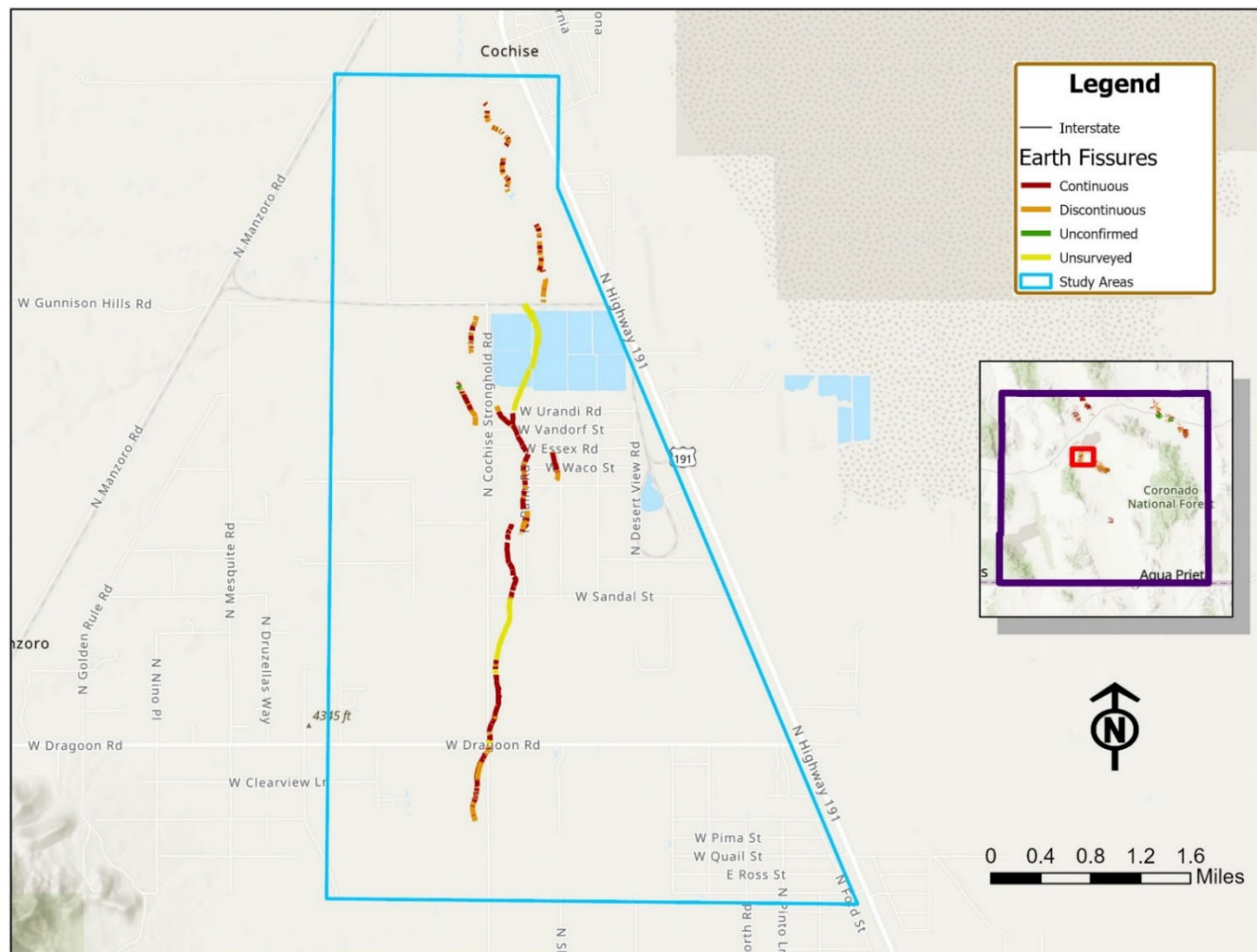


Figure 5.22 – Fissure Locations Elfrida

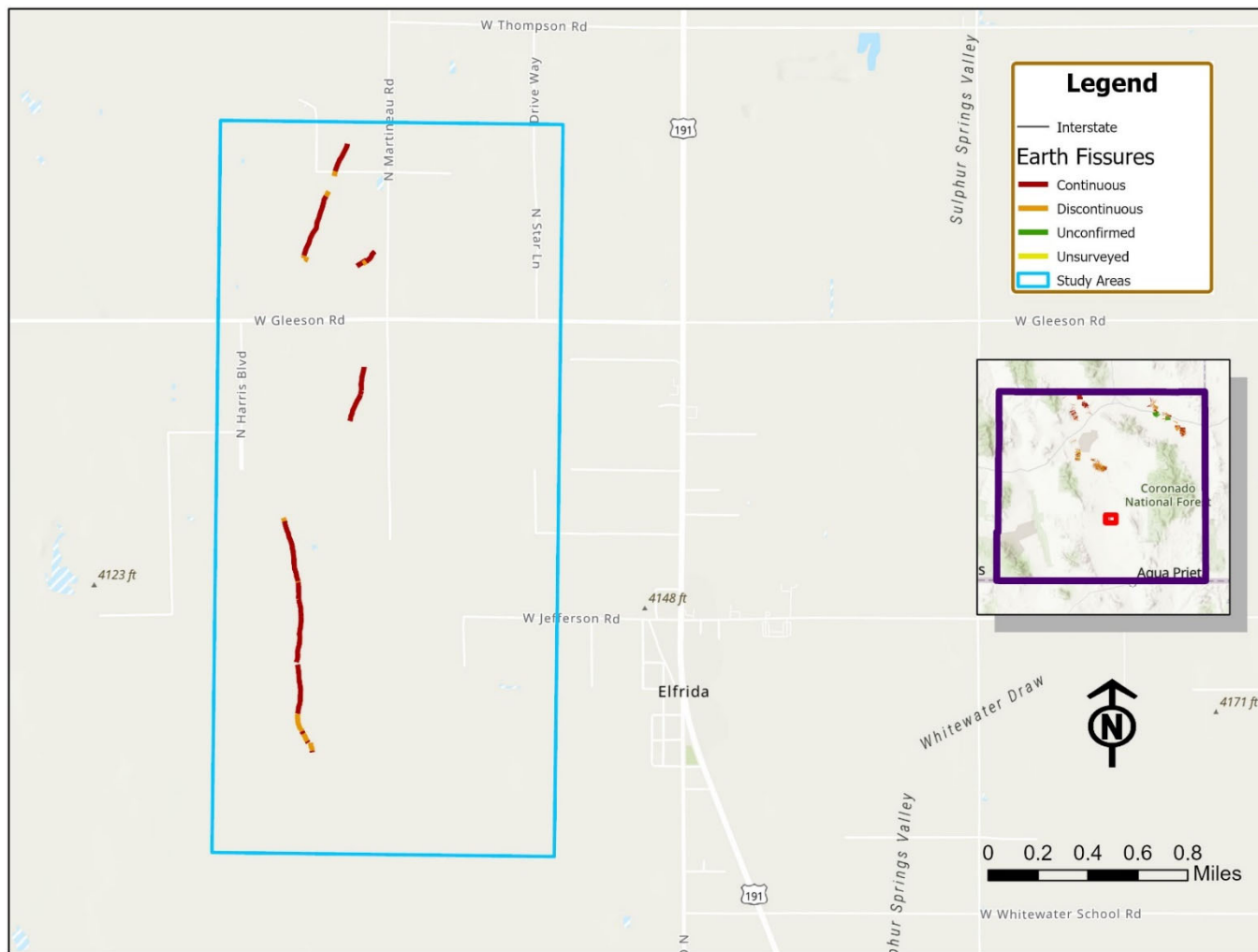


Figure 5.23. – Fissure Locations North Sulfur Springs Valley

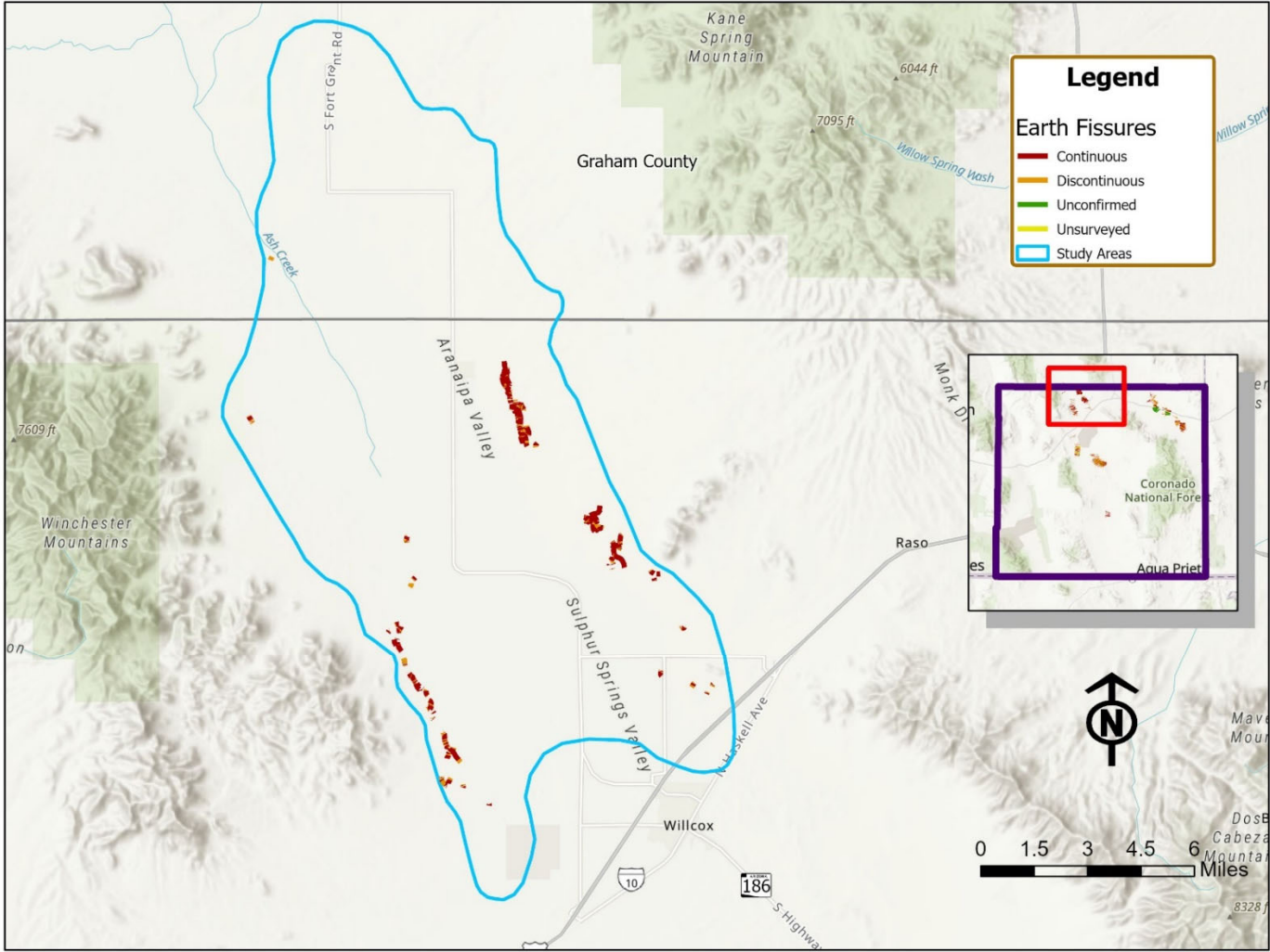
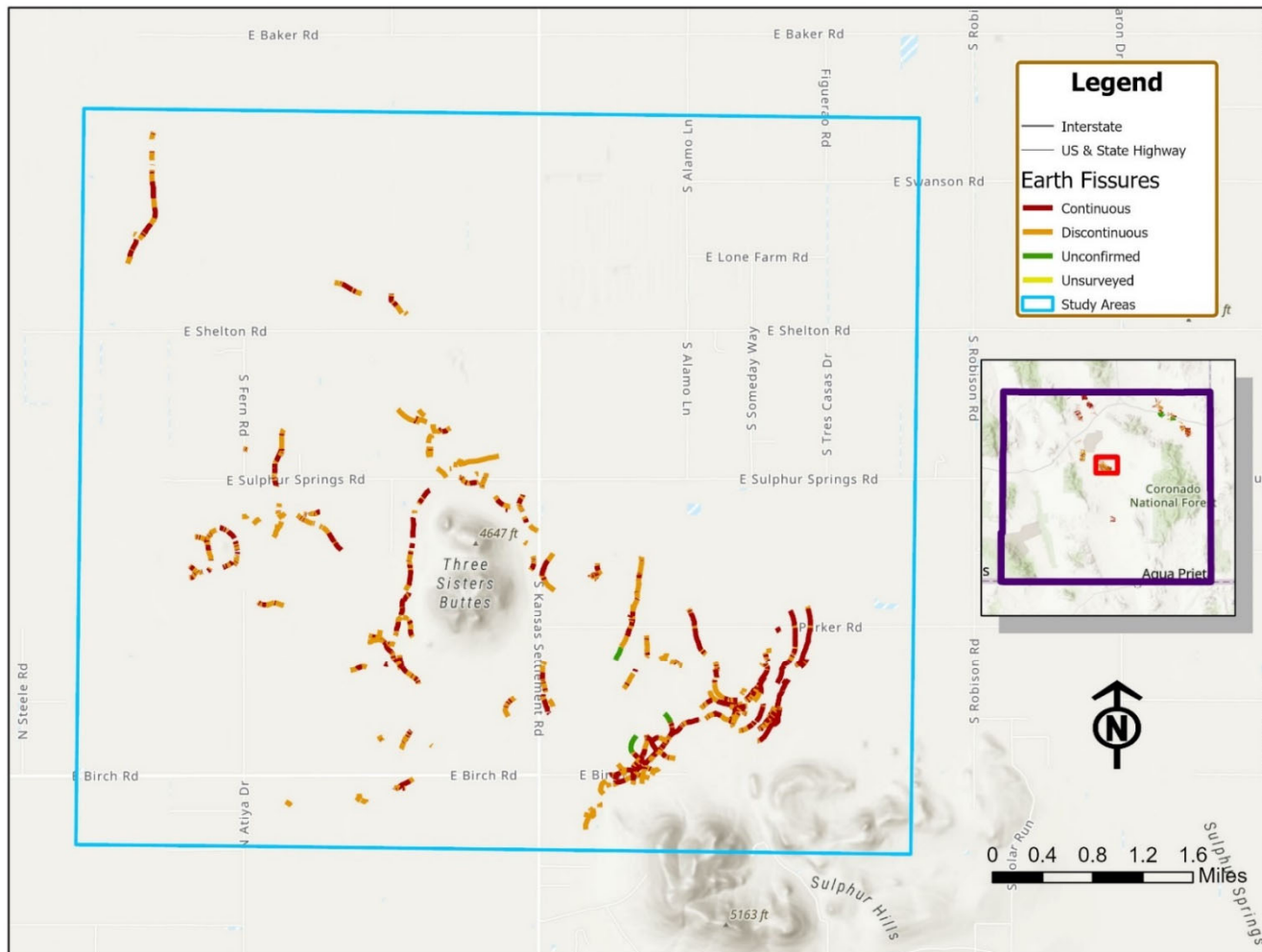


Figure 5.24. – Fissure Locations Three Sisters Buttes



### 5.3.5 Flood/Flash Flood

#### Description

For this Plan, the flooding hazard addressed in this section will pertain to floods resulting from precipitation/runoff-related events. Flooding due to dam or levee failures is handled separately. The three seasonal atmospheric events that tend to trigger floods in Cochise County are:

- *Tropical Storm Remnants*: Some of the worst flooding tends to occur when the remnants of a hurricane downgraded to a tropical storm or tropical depression enter the State. These events occur infrequently and mainly in the early autumn and usually bring heavy and intense precipitation over large regions, causing severe flooding.
- *Winter Rains*: Winter threatens low-intensity but long-duration rains covering large areas that cause extensive flooding and erosion, particularly when combined with snowmelt.
- *Summer Monsoons*: In mid to late summer, the monsoon winds bring humid subtropical air into the State. Solar heating triggers afternoon and evening thunderstorms, producing extremely intense, short bursts of rainfall. The thunderstorm rains are mostly translated into runoff. In some instances, the accumulation of runoff occurs very quickly, resulting in a rapidly moving flood wave referred to as a flash flood. Flash floods tend to be very localized and cause significant flooding of local watercourses.

Damaging floods in the County include riverine, sheet, alluvial fan, and local area flooding. Riverine flooding occurs along established watercourses when the bank-full capacity of a waterway is exceeded by storm runoff or snowmelt, and the overbank areas become inundated. Sheet flooding occurs in regionally low areas with little topographic relief that can generate floodplains over a mile wide. Alluvial fan flooding is generally located in piedmont areas near the base of the local mountains. It is characterized by multiple, highly unstable flowpaths that can rapidly change during flooding events. Local area flooding often results from poorly designed or planned development wherein natural flowpaths are altered, blocked, or obliterated, and localized ponding and conveyance problems result. Erosion is also often associated with damage due to flooding.

Another significant flood hazard comes as a secondary impact of wildfires in the form of dramatically increased runoff from ordinary rainfall events on newly burned watersheds. The primary factors contributing to the increased runoff are denuding of the vegetative canopy and forest floor and the development of hydrophobic soils. Canopy and floor-level brushes and grasses intercept and store significant rainfall during a storm event. They also add to the overall watershed roughness, which generally attenuates the ultimate peak discharges. Soils in a wildfire burn area can be rendered hydrophobic, which is the development of a thin layer of nearly impervious soil at or below the mineral soil surface resulting from a waxy substance derived from plant material burned during a fire. The waxy substance penetrates the soil as a gas and solidifies after it cools, forming a waxy coating around soil particles. Hydrophobic soils, in combination with a denuded watershed, will significantly increase the runoff potential, turning a routine annual rainfall event into a raging flood with a drastically increased potential for soil erosion and mud and debris flows.

#### History

Flooding is a significant hazard in Cochise County, as shown in the number of declared disaster events seen in Section 5.1. Cochise County has been part of ten (10) flood-related disaster declarations since 1966<sup>47</sup>. There have been numerous other non-declared events of reported

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<sup>47</sup> Arizona Department of Emergency and Military Affairs. (2022). *Emergency Management: Infrastructure*. Retrieved September 14, 2022, from DEMA Emergency Declarations 1966 to Present: <https://dema.az.gov/emergency-management/operationscoordination/recovery-branch/infrastructure>



flooding incidents in the County. Over 198 flood and flash flooding events have occurred since 1996, according to the National Centers for Environmental Information (NCEI) database<sup>48</sup>. Out of these 198 flood and flash flood events, the database reported twelve direct deaths and seven injuries. Over \$4.039 million in estimated property damage also occurred due to these events during this timeframe. Since the beginning of 2017, thirty-six of these flooding events have occurred, taking one life and causing \$625,000 in damages and three injuries.

The following incidents represent examples of significant flooding that have impacted the County since 2017 from the NCEI database:

- In July 2017, heavy rain caused Rock Creek and Turkey Creek to overflow their banks and forced road closures of Turkey Creek Road, Cross Creek Road, and State Route 181. Some yards were flooded, and some residents were cut off for several days due to washed-out roads. Flash flooding caused a vehicle to be swept away on Cascabel Road. The driver was swept three-quarters of a mile downstream to the San Pedro River resulting in the need to be rescued. The damages were reported at \$40,000.
- In August 2018, 1.5 to 2 inches of heavy rain fell just over two hours east of the 2017 Lizard Fire burn scar. A motorist drowned when his car became stuck in flood waters on Cochise Stronghold Road a mile south of Dragoon Road.
- In September 2018, thunderstorms produced periods of heavy rain totaling 2 to 3 inches during the early morning hours. Interstate 10 near Bowie was closed in both directions due to flash flooding. Several swift water rescues were performed.
- In August 2019, two inches of rain in 1 to 2 hours flooded many yards and several homes in the St. David area. Some vehicles became stuck in floodwaters. Damage was reported at \$50,000.
- In September 2019, in separate incidents throughout the County, at least three cars were stranded in flood waters 1 to 2 feet deep, and six homes had at least minor flooding in Douglas from 2 to 4 inches of rain that fell on the city's east side. A retaining wall was washed out near 8th Street and Washington Street. Much of the runoff drained into a baseball field, filling it with water 3 to 4 feet deep. Damage was reported at \$50,000.
- In September 2020, nearly three inches fell in two hours southwest of St. David. Flash flooding occurred over a small stretch of Highway 90 north of Kartchner Caverns and eastward to the western reaches of St. David, where both Sabin and Patton Roads were closed due to flooding. Significant sedimentation caused one small stream to widen beyond its normal reaches, flooding several yards and two homes. Route 80 northwest of St. David was also flooded as the culvert became overwhelmed by sediment and flood waters. Damage was reported at \$35,000.
- In July 2021, one to three inches of rain in 90 minutes in the Cornfield Canyon watershed caused flash flooding. As two females, who had exited their vehicle, were viewing the stream at Ocotillo Road, a further rise in water levels swept them downstream. One was rescued about three-quarters of a mile away, while the other was finally located in the San Pedro River the following day. Both sustained minor injuries. Heavy rain of 1.5 to 2.5 fell in less than 1 hour in the Douglas area, causing flash flooding of streets and causing the closure of Washington Ave, where several homes were flooded again. Kings Highway, just north of State Route 80, was closed west of town due to flooding. Damage was

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<sup>48</sup> National Centers for Environmental Information. (2022). *Storm Events Database*. Retrieved September 14, 2022, from <https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=4%2CARIZONA>

reported at \$100,000.

- In August 2021, there were numerous flooding and flash flood events. Flash flooding of roadways occurred in Benson and State Route 80 in St. David. In Benson, one house and the community center were flooded. Highway 191 near Birch Road was flooded. Gleeson Road was washed out near milepost 20, and a swift water rescue occurred at milepost 14. Two vehicle occupants that drove into floodwaters were rescued 8 miles north of Mescal on Mescal Road. One person was rescued from their vehicle in floodwaters on Pedregosa Road near State Route 80. Leslie Canyon Road, Glen Roads, and Washington Street were closed due to flooding near Douglas. Floodwaters in Silver Creek just west of the San Bernardino National Wildlife Refuge damaged nine metal gates of the international border wall and undermined a channel bank armoring and a bridge upstream of the border wall. Floodwaters deposited several rocks on State Route 80 near N. Old Divide Road northwest of Bisbee and caused the closure of Moson and Escapule Roads and the junction of State Routes 80 and 90 east of Sierra Vista. Along Davis Road near milepost 13, six motorists were rescued from three vehicles amidst floodwaters. Courtland and Jefferson Roads, northwest of Elfrida, were also closed due to flooding. Two to four inches of rain in 3 hours in the southern Chiricahua Mountains caused flash flooding of streams over and west of the mountains. Two motorists in one vehicle were stuck in floodwaters east of McNeal on Davis Road near milepost 30. An elderly male attempted to drive through waters to rescue them when his car was swept downstream. He was rescued but not before suffering hypothermia. Damages in August 2021 were over \$321,000 throughout the County.
- In July 2022, scattered thunderstorms moved north across parts of southeast Arizona, and one storm produced flash flooding west of the Chiricahua Mountains. Heavy rain of 3-5 inches in 2 hours caused high flows on Turkey Creek. Fort Bowie Road was washed out well downstream. Later in July, a strong monsoon storm produced flash flooding and rock slides across State Route 80 northwest of Bisbee. That same July afternoon, storms produced rainfall of 1.5 inches in an hour, causing flash flooding and the closure of Dragoon Road south of Interstate 10.

### Probability and Magnitude

For this Plan, the probability and magnitude of flood hazards in Cochise County jurisdictions are primarily based on the 1% annual chance flood event (100-year) floodplains delineated on FEMA Flood Insurance Rate Maps (FIRMs) based on the update effective on 10/20/2016<sup>49</sup>. Digital Flood Insurance Rate Maps (DFIRM) floodplain GIS base files were obtained from FEMA and are the basis for the flood hazard depictions in this Plan.

Figure 5.25 shows the flood hazard areas for the entire County. Figures 5.26 through 5.32 show the flood hazard areas for the participating jurisdictions.

### Extent

The magnitude or strength of floods is measured in rainfall intensity, depth, and velocity. Storm location throughout Cochise County is sporadic due to the nature of the thunderstorm patterns of the southwest. The County is vulnerable to different types of flood and flash flood events depending on the location, topography, infrastructure, drought status, and numerous other factors. The extent of flood events is described in this section through the historical events and vulnerabilities and is considered consistent with these events and descriptions.

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<sup>49</sup> Federal Emergency Management Agency. (2016). FEMA Flood Map Service Center. Retrieved October 4, 2022, from <https://msc.fema.gov/portal/advanceSearch#searchresultsanchor>



## Vulnerability – CPRI Results

Flooding CPRI results for each community are summarized in the following Table.

Table 5.8. CPRI Results by Jurisdiction for Flooding					
Participating Jurisdiction	Probability	Magnitude/Severity	Warning Time	Duration	CPRI Score
Benson	3	3	3	2	2.90
Bisbee	4	3	2.5	2.5	3.33
Douglas	2	1	1	4	1.75
Huachuca City	4	3	4	2	3.50
Sierra Vista	4	2	4	2	3.20
Tombstone	2	2	3	2	2.15
Willcox	2	1.25	0.75	0.25	1.41
Unincorporated County	3.5	2.5	3	2.5	3.03
County-wide average CPRI =					2.62

Based on the CPRI Evaluation, Benson, Bisbee, Huachuca City, Sierra Vista, and those living or working in unincorporated Cochise County are most at risk from a flood event. As demonstrated in the Table above, the probability of this event occurring in these jurisdictions is deemed more likely, and the magnitude of flooding impacts is thought to be more severe. It should be noted that almost all jurisdictions feel that a flood event is highly likely to occur.

Even though the City of Benson has not had any significant events with flooding, the potential is still there. There are several washes with the right amount of rain to produce significant runoff that could overflow or cause culverts to be blocked, resulting in potential damage to structures. The washes on West Union Street, Adams Street, and Dragoon and 7th Street have the most potential to cause damage.

As mentioned in the Building Collapse/Mine Subsidence hazard, the Mule Gulch/Bisbee Chancel in Bisbee does not have the capacity for a 100-year storm in the City of Bisbee. However, the 10-year peak discharge of 900 CFS is contained within the channel banks. Utility and wastewater lines run the length of the flood drainage system in Bisbee and are at risk if flooding is too great and channel walls and bridge decks fail. The bridge decks span the channel at different streets and are often the only ingress/egress for entire neighborhoods. Major flooding that overtops the Mule Gulch could cause bridge deck failure, keeping emergency vehicles from entering affected areas, hampering daily living activities, or creating logistically challenging and dangerous evacuation situations in the event of fire or wildfire. There is also a risk of sanitary sewer overflow if excessive rainfall exceeds water plant capacity. Historic buildings are especially vulnerable to sewage backup.

For Bisbee, the recommended concept is to construct a concrete wall abutting the existing wall and refurbish the bridge decks. Potential phasing of the improvements will be identified during the design phase based on the critically damaged areas of the wall, impacts to utilities, impacts to Tombstone Canyon Road and associated traffic, construction constraints (channel flows, bedrock formation), and other issues which may be identified with the final design per a 2019 Drainage Report commissioned by Bisbee. Cochise County has obtained quitclaim conveyance information from the mining company that the underground drainage culvert is solely for stormwater and has been transferred to the City of Bisbee for operation and maintenance. For many years it has been

requested to re-analyze the culverts of Mule Gulch and Brewery Gulch because of some concerns. One being elevation differences in the original FEMA model and another for insufficient capacity of the conveyance system. FEMA is currently remapping the Bisbee area and will re-analyze the stormwater conveyance system.

In Huachuca City, flooding occurs on several town streets routinely during monsoon season, including Seminole Place, Buffalo Drive, McCray Street, Gila Road, and Santa Cruz Road. Mustang Road also experiences significant flooding during rain events which cause it to wash out. The Wastewater Holding Facility located on the northeast boundary of Huachuca City is vulnerable to flooding of the Babocomari. Two holding ponds are gravity fed and hold all the town sewage. Any breach of the holding ponds would affect everything downstream from the facility. Flooding of this facility could also cause contaminants to flow into the Babocomari located north of the facility.

Huachuca City has a major housing area in the flood plain on the north end of town. A community center and a town park are located in the floodplain. Flooding of the Babocomari would have a significant impact on those residents as well as our Town facilities. The Babocomari has not flooded recently but has been identified and remapped by FEMA to indicate it is in the 100-year flood zone.

In Sierra Vista, flooding and flash floods are a regular occurrence during monsoon season. Most events are limited in duration and severity and do not lead to ongoing issues. A majority of the City's infrastructure is built to minimize damage from a 100-year or smaller storm. However, older areas of the City were constructed to a different standard and are more susceptible to damage from smaller storms. The damage would generally contain minor flooding, stormwater facility damage, and overflows of the City's sewage collection system. Downed trees are also a possibility if the flooding is followed by wind.

In Willcox, annual flash flooding causes street closures during the monsoon and with major rainfall throughout the year. Not only are local roads affected, but shutdowns on Interstate 10 also redirect traffic through Willcox's commercial district and residential areas increasing maintenance costs and diverting resources for traffic control from public safety. The absence of adequate drainage forces water onto the roadways, undermining the stability of the pavement and facilitating the need for major repairs to transportation infrastructure after the monsoon season, January storms, and throughout the year.

Cochise County Engineering & Natural Resources Department (ENR) has requested assistance removing the Leslie Road detention pond. ADWR has categorized this as a small dam with a high hazard potential per Arizona Administrative Code (AAC) R12-15-1206. In 2012 the dam breached due to a large storm event sending stormwater through the subdivision, eroding some parcels, and Cochise County maintained roads. ADWR has conducted yearly site inspections of the dam since 2013. Fill material from within the detention basin was used to temporarily fix the breached area. In August 2020, ENR and Cochise County's Office of Emergency Services (OES) prepared an Emergency Action Plan, using water level sensors to warn residents at different stages that the dam was filling and at what point to prepare to evacuate. However, the water level sensors that OES had installed were vandalized, resulting in residents not being warned during the 2021 monsoon, which partially filled the detention basin and then overtopped the southern breach again. This dam currently belongs to LCWUA and is located within the Cochise College Park Unit 6 (Coronado Lakes Estates) subdivision. However, LCWUA does not have funding to repair breaches nor remove them from jurisdictional status.

Cochise County has requested assistance with funding to remove the dam from jurisdictional status and repair the breaches to keep stormwater from being diverted and washing out County maintained roads, control stormwater to flow along its original downstream path, eliminate the high hazard and remove the dam from ADWR jurisdictional dam status. ENR is contracting with a civil engineering firm to propose a design that will utilize the storage capacity of the existing dam during storm events, allow the stormwater to overtop a designed overflow outlet weir, and flow

in its natural direction.

#### Vulnerability – Loss Estimations

Expected annual losses from Riverine Flooding from the National Risk Index report for Cochise County are considered relatively moderate at \$2.9 million. The Frequency is 6.3 events per year, and the Exposure is 0.13 trillion<sup>50</sup>.

The potential exposure to flooding risk was estimated by intersecting the county parcel data with the SFHA data. The following Table 5.9 displays the total number of impacted parcels in the Special Flood Hazard Areas (SFHA, i.e., 100-year floodplain) for each participating jurisdiction provided by Cochise County Flood Control.

Table 5.9. Impacted Parcels (Flood)	
Jurisdiction	Parcels (SFHA)
Benson	128
Tombstone	95
Willcox	4,052
Bisbee	2,366
Douglas	9,98
Sierra Vista	1,456
Huachuca City	3,38
County (Unincorporated)	26,418
Total SFHA Parcels:	35,851

Per First Street Foundation's Flood risk factor evaluation referenced by the City of Bisbee<sup>51</sup>:

- There are 1,108 properties in Bisbee with a greater than 26% chance of being severely affected by flooding over the next 30 years. This represents 27% of all properties in Bisbee.
- Risk assessment
  - Residential Severe Risk 810 out of 2,881 homes.
  - Road Severe Risk 29 out of 77 miles of roads.
  - Commercial Extreme Risk 162 out of 284 commercial properties.
  - Critical Infrastructure Major Risk 1 out of 4 infrastructure facilities.
  - Social Facilities Severe Risk 16 out of 25 social facilities. This includes schools, houses of worship, museums, and government and historic buildings.

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<sup>50</sup> Federal Emergency Management Agency. (2022). National Risk Index. Retrieved July 7, 2022, from <https://hazards.fema.gov/nri/map#>

<sup>51</sup> First Street Foundation. (n.d.). Flood Risk Overview: Does Bisbee Have Risk? *Risk Factor*. Retrieved October 17, 2022, from [https://riskfactor.com/city/Bisbee-Arizona/406260\\_fsid/flood](https://riskfactor.com/city/Bisbee-Arizona/406260_fsid/flood)

A low-likelihood storm resulting in severe flooding (a 1-in-100-year flood event) could affect 1,082 properties in Bisbee. This type of event has a 26% chance of occurring at least once over the life of a 30-year mortgage. Thirty years from now, an event of this same likelihood would affect 1,108 properties due to a changing environment.

Recurrent flooding of Huachuca City streets is creating significant damage to the roads, causing the need for costly repairs and impacting residents' ability to get to or from their homes. They recently incurred costs to upgrade their retention capabilities at their wastewater treatment plant.

Approximately \$259 million in critical facility-related losses are estimated for flood hazards in the 2016 SFHA for all the participating jurisdictions in Cochise County. The current Community Rating System Program Data for the County reports 14,463 buildings in the SFHA with a total acreage of 242,508.7 acres.

From a jurisdictional viewpoint, Wilcox, Bisbee, and the unincorporated County areas are most at risk of a flood event. However, all jurisdictions have localized areas of their communities at risk for floods and flash floods. Community members' perceptions of the flood risk can vary due to the localization of floods in the southwest. All community members are vulnerable to flooding through travel, residences, or businesses. There is always a need for better community outreach and education around preparing for and preventing losses from flood hazards.

All infrastructure in floodplains and potential flooding areas is also vulnerable. Based on past flooding experiences, bridge structures are often the most at risk of the effects of a flood event. This is especially important to consider when assessing the risk presented by flood events. The loss of bridges can have a cascading impact on a jurisdiction if transportation and evacuation routes are rendered inaccessible. There are numerous areas within the County where low-lying crossings impact the ability of residents to leave or get to their properties for more than short periods.

#### Vulnerability – Repetitive Loss Properties

Repetitive Loss (RL) properties are those NFIP-insured properties that, since 1978, have experienced multiple flood losses. FEMA tracks RL property statistics to identify Severe RL (SRL) properties. RL properties demonstrate a track record of repeated flooding for a particular location and are one element of the vulnerability analysis. RL properties are also crucial to the NFIP since flood structures frequently strain the National Flood Insurance Fund. FEMA records dated September 2016 (provided by ADEMA) indicate no identified RL or SRL property in Cochise County.

Although not considered repetitive loss properties according to FEMA, several locations throughout the county have experience with properties that receive repeat damages due to localized flooding. During the 2019 and 2021 monsoon seasons, Douglas experienced "100-year flood" events due to the amount of rainfall received. In 2019, the storm runoff affected five residences on the east side of town; in 2021, three residences – one previously affected in 2019 – were affected by storm runoff.

#### Vulnerability – Development Trends

Over the last five years, Cochise County and the incorporated jurisdictions of Douglas and Sierra Vista have experienced moderate growth. The flood hazards will likely impact all future growth areas. Growth areas located just outside of Wilcox and Douglas are expected to be at an even higher risk due to the density of floodplains and floodways in those areas. Aside from future growth areas, all areas of the County and jurisdictions will see impacts from flood events. Most flood-prone properties in Cochise County pre-date the planning jurisdictions' entry into the NFIP and were constructed before current floodplain management practices. The development of new properties or substantial re-development of existing structures is now subject to regulatory review procedures implemented by each jurisdiction throughout the County. Challenges to managing new

growth include converting approximate floodplain delineations into detailed delineations to better mitigate against flood risks and establishing additional floodplain delineations to identify and map the flood hazards within the growth areas where no mapping currently exists.

In Bisbee, in an area known as Tin Town, a flood catch dam was placed to slow water velocity, so the road which acts as the flood water conveyance is not overwhelmed, thereby reducing the risk of flooding to 15 homes, a homeless shelter, a business, and the sewer lift system. Bisbee is also increasing the size of water pipes during water line replacement to support development and make the water system less vulnerable. They also continue maintenance on the Mule Gulch channel, replacing deteriorated concrete walls when they fail and removing weeds.

Douglas has several efforts underway to mitigate flood risk for current residents and future development. The 2018 Douglas-Agua Prieta Flood Mitigation Alternative Evaluation Study was conducted in Douglas. They are also working on a Drainage Master Plan study currently. They have received funding from Palm Grove and Rose Avenue Wash study from the U.S. Army Corps of Engineers. Improvements for flood control at their wastewater treatment plant are under design funding.

In Sierra Vista, new development within the last five years in City limits has been fairly minimal. All new infrastructure has been constructed to minimize damage from the 100-year or smaller storms.

### *National Flood Insurance Program Participation*

Participation in the NFIP is key to any community's local floodplain management and flood mitigation strategy. Cochise County and the seven other incorporated jurisdictions participate in the NFIP. Joining the NFIP requires the adoption of a floodplain management ordinance that requires jurisdictions to follow established minimum standards set forth by FEMA and the State of Arizona when developing in the floodplain. These standards require that all new buildings and substantial improvements to existing buildings be protected from damage by the 100-year flood and that new floodplain development will not aggravate existing flood problems or increase damage to other properties. As a participant in the NFIP, communities also benefit from having Flood Insurance Rate Maps (FIRM) that map identified flood hazard areas and can be used to assess flood hazard risk, regulate construction practices, and set flood insurance rates. FIRMs are also an important source of information to educate residents, government officials, and the private sector about the likelihood of flooding in their community. Table 5.10 summarizes the NFIP status and statistics for each jurisdiction participating in this Plan. The following tables (5.11 – 5.18) contain the NFIP program narratives for each jurisdiction and County.

Table 5.10. NFIP status and statistics for Cochise County and participating jurisdictions as of November 2022

Jurisdiction	Community ID	NFIP Entry Date	Current Effective Map Date	Number of Policies	Amount of Coverage (x \$1,000)	Floodplain Management Role
Cochise County	040012	12/4/1984	10/20/16	410	\$79,919	Provides floodplain management for the Unincorporated County and assistance to other jurisdictions as needed
Benson	040013	6/25/1976	2/3/2016	5	1,229	Benson provides floodplain management for the incorporated areas of the city
Bisbee	040014	1/3/1979	8/16/2006	59	\$13,147	Cochise County provides floodplain management for the city
Douglas	040015	9/29/1978	10/20/16	35	\$7,438	Douglas provides floodplain management for the incorporated areas of the city
Huachuca City	040016	2/14/1976	8/28/2008	17	\$1,958	Cochise County provides floodplain management for the city
Sierra Vista	040017	9/28/1984	2/3/2016	61	\$17,056	Sierra Vista provides floodplain management for the incorporated areas of the city
Tombstone	040106	2/16/1983	8/28/2008	1	\$0.2	Cochise County provides floodplain management for the city
Willcox	040018	7/17/1978	8/28/2008	219	\$39,433	Willcox provides floodplain management for the incorporated areas of the city
Source: FEMA Community Status Report (November 2022) URL: <a href="https://www.fema.gov/cis/AZ.html">https://www.fema.gov/cis/AZ.html</a> and Cochise County Flood Control						

Table 5.11. NFIP Compliance for Cochise County

*Describe your jurisdiction's current floodplain management/regulation process for the construction of new or substantially improved development within your jurisdiction:*

Cochise County Floodplain regulations are modeled after the ADWR's Model Ordinance. Regulatory floodplains are mapped on the County's GIS system that is available for the public to view on the main County website page.

The Flood Control District is obtaining a 5-year contract to maintain/control vegetation within dedicated drainage easements to remove non-native, invasive and channel-obstructing vegetation.

When a development proposal/permit is submitted through our Online Portal – Citizen Serve, the Development Services Staff reviews and advises the applicant that the proposed property is in a Special Flood Hazard Area (SFHA). The applicant will then submit a Floodplain Use Permit along with a site plan and proposed drawing to be reviewed by FCD staff. Once the permit application is reviewed, depending on the proposed construction, a Floodplain Use Permit will be issued with elevation requirements and setbacks distances from a wash if applicable. To comply with Floodplain Regulations, the applicant must submit a completed Elevation Certificate or Wet-Floodproofing Certificate to verify structures were built to code.

*Describe the status or validity of the current floodplain hazard mapping for your jurisdiction:*

Updated Countywide Digital Flood Insurance Rate Map (FIRM) Panels became effective on August 8, 2008, and were updated on February 13, 2016. These maps determine if a particular property is in a 100-year Floodplain.

Portions of the County are currently being re-studied with the assistance of FEMA. Areas that will be remapped are Bisbee, Benson, and St. David. Remapping these areas is tentatively planned to be effective in August 2023. The purpose of this map revision is to correctly capture the Floodplain boundaries.

*Describe any community assistance activities (e.g., help with obtaining Elevation Certificates, flood hazard identification assistance, flood insurance acquisition guidance, public involvement activities, etc.):*

We work closely with ADWR to ensure compliance and mitigate issues found through our Community Assistance Visit in April 2022.

Before being approved for final inspection, a Post Construction Elevation Certificate and pictures must be completed and submitted to our office by fax, mail, email, or in person.

*Describe identified needs in your floodplain management program. This could include updating the floodplain management code/regulation, establishing written review procedures, modifying, or adding flood hazard area mapping, etc.*

We are revising our Floodplain Regulations to have more stringent requirements when building in an SFHA and to include Agricultural property requirements. Our Attorney's office and ADWR will review these regulations. This is tentatively planned to be presented and approved by the

Board in October 2022.

Table 5.12. NFIP Compliance for Benson

*Describe your jurisdiction's current floodplain management/regulation process for the construction of new or substantially improved development within your jurisdiction:*

The City's floodplain regulations are contained in City Code Chapter 17, "Flood Damage Prevention," which is from ADWR's Model Ordinance. Regulatory floodplains are mapped on Cochise County's GIS system. Private development reviews verify that no infringement occurs within the floodplain or is appropriately mitigated within that project.

When a development is submitted through the Electronic Plan Review to Development Services staff, and all or some portion of the property is in the SFHA, the application is sent to Cochise County Flood Control District and Building Department for review. This lets staff know that the development must comply with the City of Benson and Cochise County's ordinances related to NFIP.

*Describe the status or validity of the current floodplain hazard mapping for your jurisdiction:*

Federal Insurance Rate Map (FIRM) Panels became effective on August 28, 2008, and many were updated on February 3, 2016. Currently, these maps, in addition to Letters of Map Change (LOMC), may be used to determine if a particular property is in a 100-year floodplain.

*Describe any community assistance activities (e.g., help with obtaining Elevation Certificates, flood hazard identification assistance, flood insurance acquisition guidance, public involvement activities, etc.):*

The City Does not provide any additional assistance that the Cochise County Flood Control District does not offer.

*Describe identified needs in your floodplain management program. This could include updating the floodplain management code/regulation, establishing written review procedures, modifying, or adding flood hazard area mapping, etc.*

The City could use assistance to perform further mapping, but all large waterways are currently covered. The City has also identified floodways that could be dredged to improve properties that have historically had flooding issues.



Table 5.13. NFIP Compliance for Bisbee
<i>Describe your jurisdiction's current floodplain management/regulation process for the construction of new or substantially improved development within your jurisdiction:</i>
<p>The City of Bisbee defers to Cochise County floodplain regulations. The city has an extensive vegetation maintenance/control program in and around the flood management channels and flood plain. Floodplains are mapped on the County GIS system as well as FEMA. Cochise County Floodplain Regulations require private development reviews to verify that no infringement occurs within the floodplain (or that infringement is appropriately mitigated within that project).</p> <p>When a development is submitted through the building permits and right of ways permitting process, submittals are reviewed by the building inspector. The building inspector reviews FEMA flood maps, and if a project is in the flood plains, then no building permit will be issued until the builder has acquired a Floodplain Use Permit from Cochise County Flood Control District.</p>
<i>Describe the status or validity of the current floodplain hazard mapping for your jurisdiction:</i>
<p>Current flood planning is organized and managed by Cochise County through GIS mapping. The City of Bisbee utilizes these maps along with FEMA floodplain maps to evaluate the risk of flooding and determine if a particular piece of property is in a 100-year floodplain.</p>
<i>Describe any community assistance activities (e.g., help with obtaining Elevation Certificates, flood hazard identification assistance, flood insurance acquisition guidance, public involvement activities, etc.):</i>
<p>The City of Bisbee utilizes community-based committees to discuss flood risks of development projects. These include Planning and Zoning, Streets, and Infrastructure committees. The County also provides floodplain maps as public information.</p> <p>As a new educational program, the City will plan several Public Open House meetings to educate the public on flood hazard areas and rules and regulations for development activities within the flood hazard areas. These meetings are coordinated with the Flood Control Department of Cochise County and the Master Planning efforts under their lead role.</p>
<i>Describe identified needs in your floodplain management program. This could include updating the floodplain management code/regulation, establishing written review procedures, modifying, or adding flood hazard area mapping, etc.</i>
<p>The City of Bisbee will continue to work with and assist the County in keeping its GIS floodplain maps up to date, keeping its Floodplain Management Plan current, and ensuring any development in the City follows County guidance. The city will develop a community education program for flood hazard mitigation, codes, and prevention. These proactive steps help reduce the risk of loss of life and property damage within the flood-prone areas in the city.</p>

Table 5.14. NFIP Compliance for Douglas
<i>Describe your jurisdiction's current floodplain management/regulation process for the construction of new or substantially improved development within your jurisdiction:</i>
<p>The City of Douglas assumes the powers and duties for floodplain management under A.R.S. §48-3610 and has adopted regulations in conformance with A.R.S. §48-3609 designed to promote the public health, safety, and general welfare of its citizenry. The Floodplain Management Plan is contained in section 15.20 of the Douglas Municipal Code. It applies to all areas of special flood hazards within the City of Douglas corporate limits. The plan includes general provisions, administration procedures, provisions for flood hazard reduction, standards recommended by the State of Arizona, and stormwater pollution prevention.</p> <p>The City Engineer is appointed as the Floodplain Administrator - authorized to administer, implement, and enforce this ordinance by granting or denying development permits per its provisions.</p>
<i>Describe the status or validity of the current floodplain hazard mapping for your jurisdiction:</i>
<p>The areas of special flood hazard identified by the Federal Emergency Management Agency in a scientific and engineering report entitled "The Flood Insurance Study (FIS) for Cochise County, Arizona, and Incorporated Areas" dated February 3, 2016 (revised) with accompanying flood insurance rate maps (FIRMs) dated August 28, 2008, and all subsequent amendments or revisions, were adopted by reference and declared to be a part of the Floodplain Management Plan. This FIS and attendant mapping are the minimum areas of plan applicability. Studies may supplement for other areas which allow implementation of the plan and which are recommended to the Floodplain Board by the Floodplain Administrator. The Floodplain Board, within its area of jurisdiction, shall delineate (or may, by rule, require developers of land to delineate) for areas where development is ongoing or imminent, and thereafter as development becomes imminent, floodplains consistent with the criteria developed by the Federal Emergency Management Agency and the Director of the Arizona Department of Water Resources. The FIS and FIRM panels are on file at the City of Douglas Public Works Department.</p>
<i>Describe any community assistance activities (e.g., help with obtaining Elevation Certificates, flood hazard identification assistance, flood insurance acquisition guidance, public involvement activities, etc.):</i>
<p>Public Works and Development Services Staff assist the public with identifying flood hazards and questions on FEMA Special Flood Hazard Areas. The City also helps the public by answering questions regarding flood insurance and elevation certificate documentation. Cochise County is also a partner in community assistance activities such as flood hazard identification, flood insurance acquisition and guidance, and public involvement. Cochise County funded the flood identification study for Washington and 8th Street, and the County provided funding for the Washington Avenue retention basin construction.</p>

*Describe identified needs in your floodplain management program. This could include updating the floodplain management code/regulation, establishing written review procedures, modifying, or adding flood hazard area mapping, etc.*

Cochise County is currently developing plans and specifications to construct retention/detention facilities in the Bay Acres area to mitigate flooding in Bay Acres and areas to the west.

The City was awarded grant funding from the Army Corps of Engineers to prepare a city-wide master drainage plan to identify and prioritize all drainage and stormwater improvements for the city and contributing watershed. The study will include an evaluation and update recommendations for current FEMA NFIP floodplains. Additionally, the "Douglas-Agua Prieta Flood Mitigation Alternative Study was completed in 2018.

The City of Douglas will be looking to review and make recommended updates to the floodplain ordinance. The current ordinance was adopted in 2016, and there have been some updates to the State Model Ordinance since then. The City of Douglas is also looking at creating a review procedure to ensure appropriate steps are taken to make new development safe and compliant. The City would like to review the current Flood Insurance Rate Maps (FIRM) maps with the County to ensure they are accurate and that the latest hydrology from NOAA is used to map flood hazards. There may be some partnership opportunities to look at updating these maps. Specifically, some mapped Special Flood Hazard Areas have non-detailed studies. They would be more effective with detailed analysis and the addition of base flood elevation information.

Table 5.15. NFIP Compliance for Huachuca City

*Describe your jurisdiction's current floodplain management/regulation process for the construction of new or substantially improved development within your jurisdiction:*

Town of Huachuca City floodplain management is done through an IGA with the Cochise County Floodplain Department. The Town Building Official is the POC for the Town. Floodplains are mapped on the County GIS system as well as FEMA. Cochise County Floodplain Regulations require private development reviews to verify that no infringement occurs within the floodplain (or that infringement is appropriately mitigated within that project.)

When a development is submitted for a building permit and/or right-of-way permit, submittals are first reviewed by the Town building official. If a project is found to be within a floodplain, the applicant is advised to first obtain a Floodplain Use Permit from the Cochise County Floodplain Dept. This Use permit must be presented to the Town Building Official before a Town permit can be issued for the project.

*Describe the status or validity of the current floodplain hazard mapping for your jurisdiction:*

The Town defers to the GIS mapping from the Cochise County Floodplain Department. These maps, along with the FEMA floodplain maps, are utilized to evaluate the risk of flooding, and determine whether a particular parcel is located within a 100-year floodplain.

*Describe any community assistance activities (e.g., help with obtaining Elevation Certificates, flood hazard identification assistance, flood insurance acquisition guidance, public involvement activities, etc.):*

Cochise County provides floodplain maps as public information. The Town in turn makes these available to the public for review as needed.

*Describe identified needs in your floodplain management program. This could include updating the floodplain management code/regulation, establishing written review procedures, modifying, or adding flood hazard area mapping, etc.*

The Town will continue to work with and assist the County in keeping its GIS floodplain maps up to date, keeping its Floodplain Management Plan current and ensuring any development within the Town limits follows the Cochise County floodplain guidelines.

Table 5.16. NFIP Compliance for Sierra Vista

*Describe your jurisdiction's current floodplain management/regulation process for the construction of new or substantially improved development within your jurisdiction:*

Sierra Vista's policies for new or substantially improved development adjacent to floodplains are contained within the City's Development Code and the Surface Water Plan. Any new development is required to dedicate, at a minimum, the limits of the 100-year floodplain. This standard prevents the construction of new structures in areas of substantial flood hazard. In areas where previous development occurred in the floodplain, the City has at times purchased properties as they have come on the market to prevent future incompatible development.

The Development Code requires all new developments to detain the difference between the pre and post-development flow on the site. This requirement has been in place for commercial properties since 1998 and was extended to residential subdivisions in 2006. The detention requirement helps to reduce development-related impacts on downstream areas.

The Surface Water Plan outlines locations for potential regional detention basins. These basins help to reduce flood peaks on a larger scale and can also be beneficial in older areas of the City that were constructed without onsite detention.

Floodplains in the City are maintained in as natural of a condition as possible to promote in-stream recharge and natural drainage characteristics per the City's Wash Maintenance Policy.

Drainage structures are required by the City's Development Code to safely convey flow from the 100-year, 1-hour storm.

*Describe the status or validity of the current floodplain hazard mapping for your jurisdiction:*

FEMA maps flood hazard areas in the City. In areas where the local knowledge indicates the flood hazard area may be incorrect, either over or

under, requests are filed with FEMA using the CLOMR/LOMR process for reevaluation. The City's Surface Water Master Plan update revisited watershed boundaries, recalculated impervious area, and examined soil characteristics to establish a more accurate measure of flow within City washes and thus anticipated floodplain boundaries.
<i>Describe any community assistance activities (e.g., help with obtaining Elevation Certificates, flood hazard identification assistance, flood insurance acquisition guidance, public involvement activities, etc.):</i>
The City provides personalized assistance to residents who have questions about floodplain boundaries and impacts on their property. An updated GIS system can overlay flood hazard areas on top of aerial photos to provide an accurate view of floodplain encroachment on different areas of the property. In cases where local knowledge indicates the flood hazard area may be incorrect, the City shares its Surface Water Master Plan data with residents and their surveyors to assist them in accurately delineating the floodplain.
<i>Describe identified needs in your floodplain management program. This could include updating the floodplain management code/regulation, establishing written review procedures, modifying, or adding flood hazard area mapping, etc.</i>
Improved coordination with FEMA is the largest need. FIRM panel updates initially take place without local input, which has resulted in some FIRMs which are incorrect. In one notable case, properties that had been removed from the floodplain only months prior were put back in the floodplain when new FIRMs were released, which was stressful for area residents and required months of further communication with FEMA to resolve. The City's new Surface Water Plan data could inform a large-scale Conditional Letter of Map Revision/Letter of Map Revision effort with FEMA. However, the cost of such an effort would be substantial and thus has not been initiated except for providing the data to support smaller, individual requests.

Table 5.17. NFIP Compliance for Tombstone
<i>Describe your jurisdiction's current floodplain management/regulation process for the construction of new or substantially improved development within your jurisdiction:</i>
<p>A development permit shall be obtained before construction or development begins within any area of a special flood hazard established in subsection 3-3-3B of this chapter. Application for a development permit shall be made on forms furnished by the floodplain administrator and may include, but not be limited to; plans in duplicate drawn to scale showing the nature, location, dimensions, and elevation of the area in question; existing or proposed structures, fill, storage of materials, drainage facilities; and the location of the foregoing.</p> <p>Advise the flood control district of Cochise County and any adjunct jurisdiction having responsibility for floodplain management in writing and provide a copy of a development plan of all applications for floodplain use permits or variances to develop land in a floodplain or floodway within one mile of the corporate limits of the city of Tombstone. Also, advise the flood control district of Cochise County in writing and provide a copy</p>

of any major development plan proposed within a floodplain or floodway which could affect floodplains, floodways, or watercourses within the district's area of jurisdiction. Written notice and a copy of the plan of development shall be sent to the district no later than three (3) working days after having been received by the floodplain administrator.

*Describe the status or validity of the current floodplain hazard mapping for your jurisdiction:*

The basis for establishing "The Areas Of Special Flood Hazard": The areas of a special flood hazard identified by the federal insurance administration in a scientific and engineering report entitled "the flood insurance study for the city of Tombstone, Arizona," with an accompanying flood insurance rate map is hereby adopted by reference and declared to be a part of this ordinance. The flood insurance study is on file at the City Clerk's office, City of Tombstone. The flood insurance study is the minimum area of applicability of this ordinance. Studies may supplement it for other areas which allow implementation of this ordinance and which are recommended to the floodplain board by the floodplain administrator.

Tombstone currently regulates, and will continue to regulate, the 100-year floodplains using the City of Tombstone floodplain management ordinance and FEMA FIRM maps, as required. Since Tombstone and its infrastructure is perched on a hill, Tombstone officials do not consider flooding from Walnut Gulch (northwest of development) a concern or a risk to the community. Therefore, flooding has not been identified as a hazard for this plan.

*Describe any community assistance activities (e.g., help with obtaining Elevation Certificates, flood hazard identification assistance, flood insurance acquisition guidance, public involvement activities, etc.):*

The City of Tombstone is committed to keeping the public informed about the City's hazard mitigation planning efforts, actions and projects. To accomplish this, the Team shall pursue the following opportunities for public involvement and dissemination of information whenever possible and appropriate:

- Provide periodic summary updates on hazard mitigation action measures implemented using local media.
- Conduct an annual presentation of hazard mitigation planning discoveries, progress, or proposed action or project measures at the Tombstone City Council Meetings.
- Perform public outreach and mitigation training meetings for targeted populations in higher-risk hazard areas (i.e., floodplain residents).

*Describe identified needs in your floodplain management program. This could include updating the floodplain management code/regulation, establishing written review procedures, modifying, or adding flood hazard area mapping, etc.*

The plan will be reviewed and referenced with revisions or updates to the planning documents. This process may include adding or revising city building codes, adding or changing zoning and subdivision ordinances, incorporating mitigation goals and strategies into comprehensive plans, and incorporating the risk assessment results into development review processes to ensure proper hazard mitigation for future development.

Table 5.18. NFIP Compliance for Willcox

*Describe your jurisdiction's current floodplain management/regulation process for the construction of new or substantially improved development within your jurisdiction:*

The City of Willcox floodplain regulations are contained in City Municipal Code Title 18, "Flood Damage Prevention," which is from ADWR's Model Ordinance. The City has an extensive vegetation maintenance/control program. It annually allocates funds to remove non-native, invasive, and channel-obstructing vegetation from selected watercourses and other City-owned properties. Regulatory floodplains are mapped on the Cochise Counties GIS system. Private development reviews verify that no infringement occurs within the floodplain (or that infringement is appropriately mitigated within that project).

When a new development has submitted a Building Permit to Development Services staff, and all or some portion of the property is in the SFHA, they must fill out a Floodplain Permit. Once the Floodplain permit has been received, this application is sent to the Building Department for review. This lets staff know that the development must comply with City's ordinances related to NFIP.

*Describe the status or validity of the current floodplain hazard mapping for your jurisdiction:*

Updated City wide Federal Insurance Rate Map (FIRM) Panels became effective on August 28, 2008. Currently, these maps, in addition to Letters of Map Change (LOMC), may be used to determine if a particular piece of property within the City limits is in a 100-year floodplain area.

*Describe any community assistance activities (e.g., help with obtaining Elevation Certificates, flood hazard identification assistance, flood insurance acquisition guidance, public involvement activities, etc.):*

Due to the FEMA FIRM mapping, the City of Willcox will provide Elevation Certificates for properties located in an SFHA. The City is an active member of the Arizona Floodplain Management Association (AFMA) and attends meetings and training at least once a year for updates on Floodplain management. These updates are then presented in City Council meetings.

*Describe identified needs in your floodplain management program. This could include updating the floodplain management code/regulation, establishing written review procedures, modifying, or adding flood hazard area mapping, etc.*

The City updated its current Floodplain Management ordinance in March 2022. Floodplains was updated following the Arizona Department of Water Resources (ADWR) guidelines as published in their model ordinances for the communities within the state. As a result of Area Drainage Master Studies (ADMS), primarily done by the FEMA's Flood Insurance study of August 28, 2008, areas subject to development activities are identified with current or future flood hazard zones. These proactive steps help reduce the risk of loss of life and livestock within the flood-prone areas in the city.

Figure 5.25. Cochise County Flood Hazard

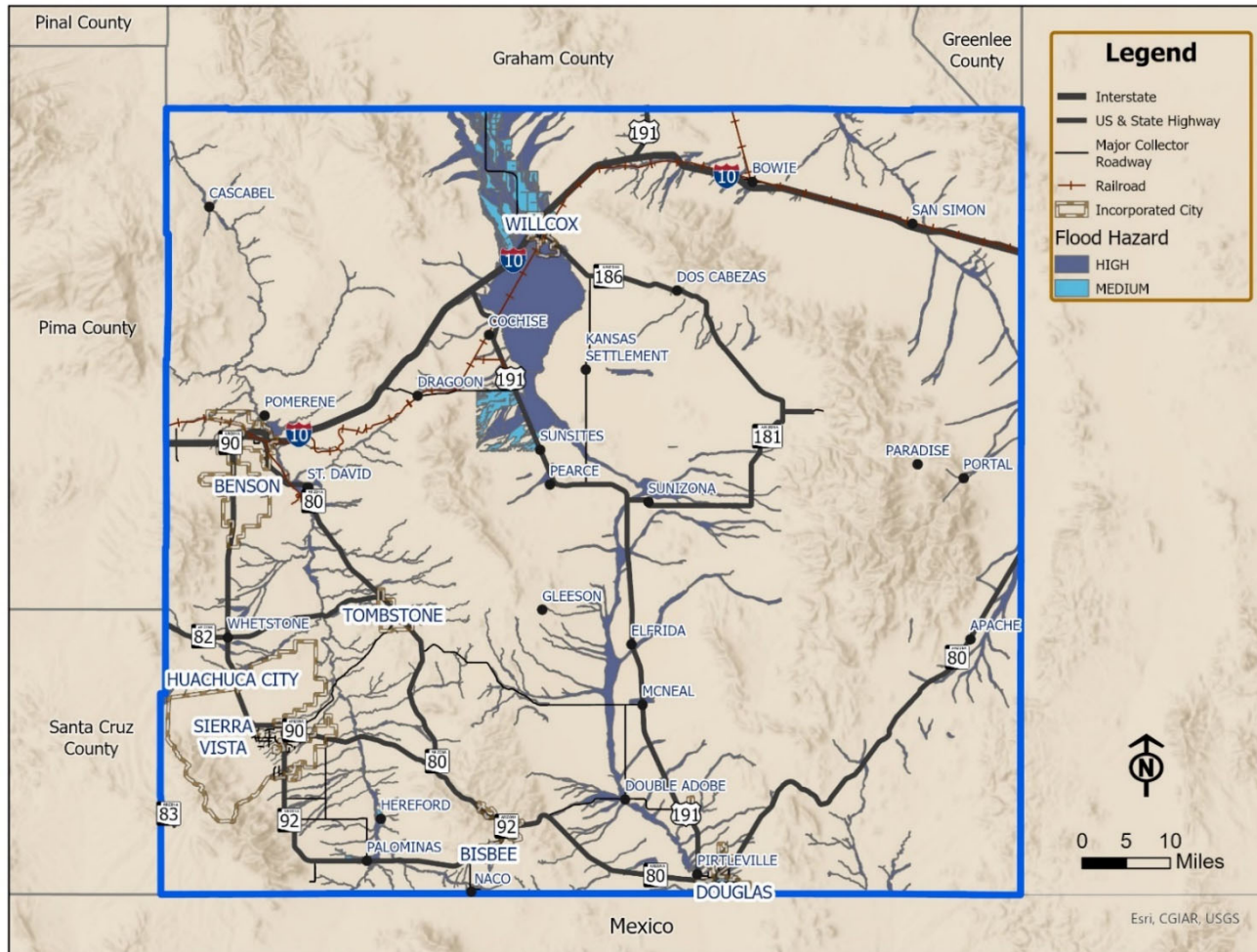




Figure 5.26. City of Willcox Flood Hazard

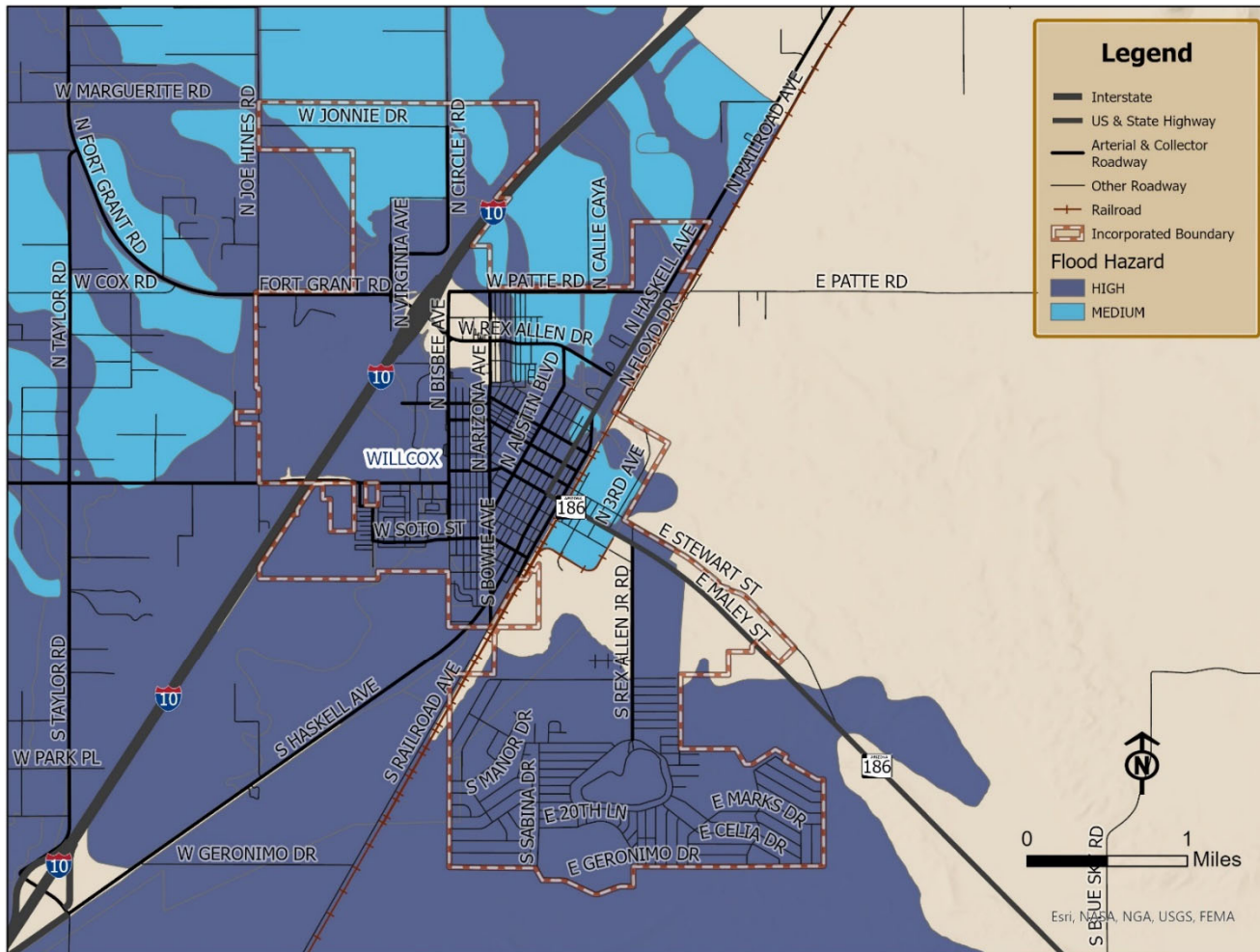


Figure 5.27. City of Tombstone Flood Hazard

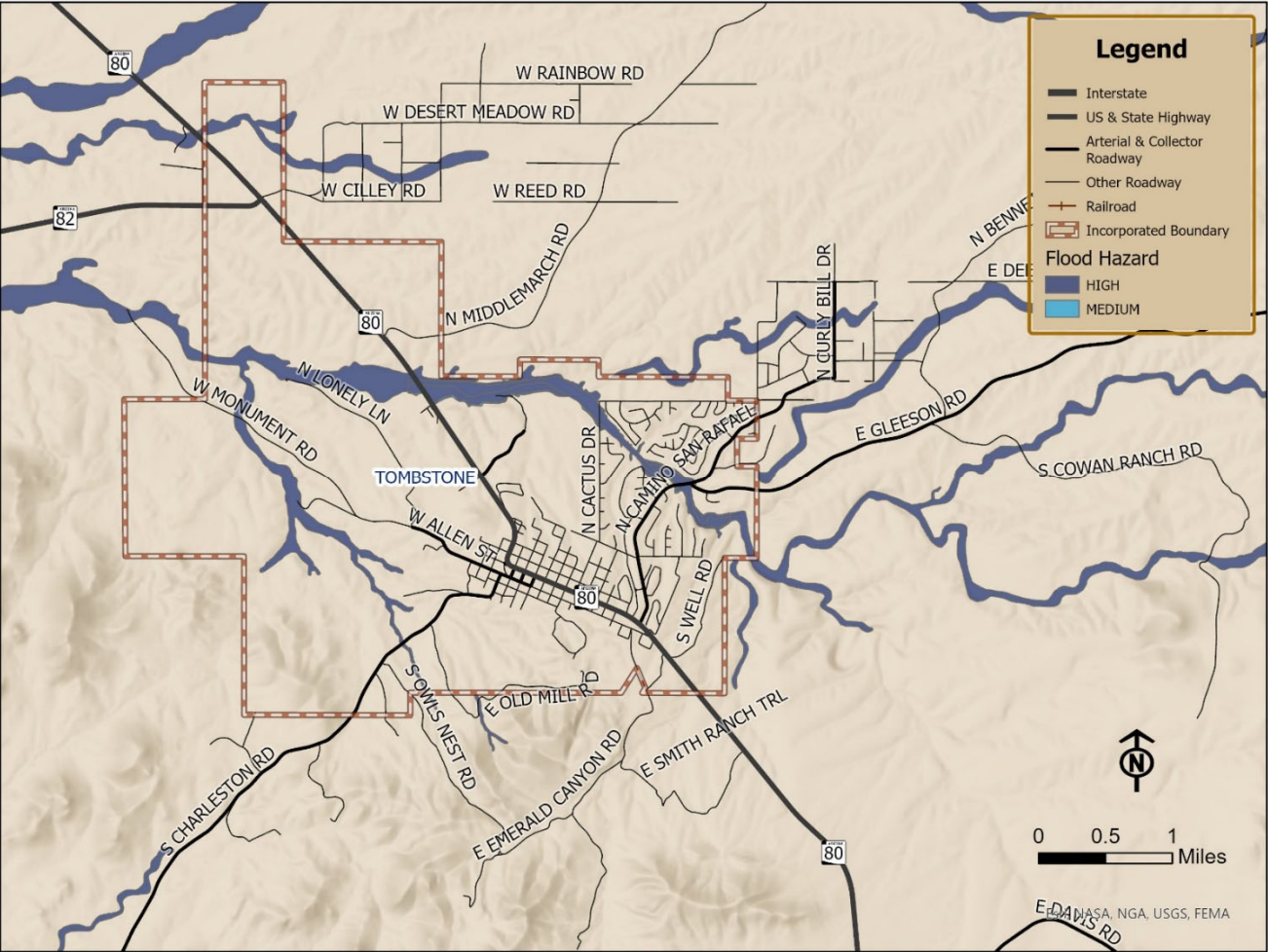


Figure 5.28. City of Sierra Vista Flood Hazard

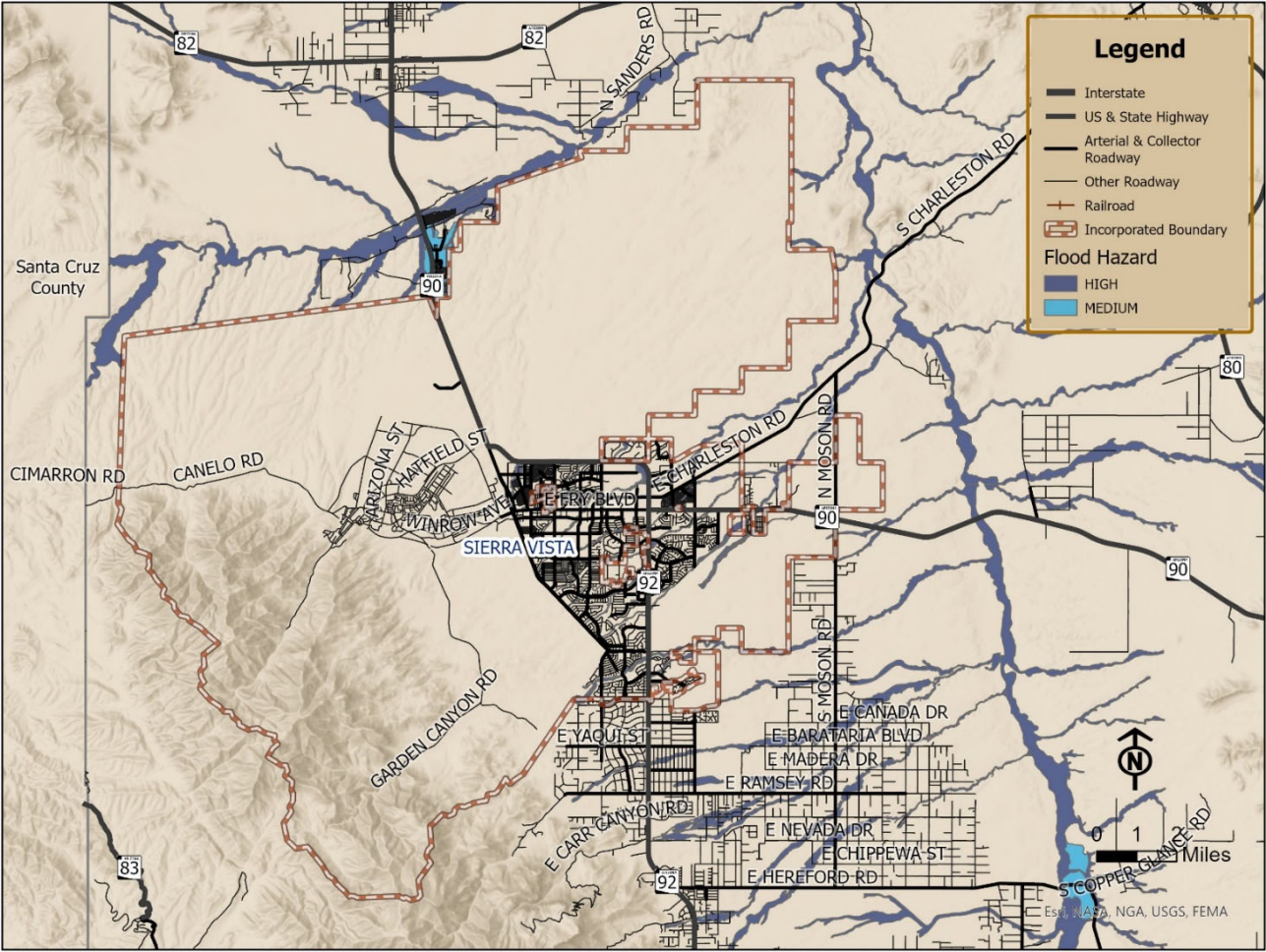




Figure 5.29. Town of Huachuca City Flood Hazard

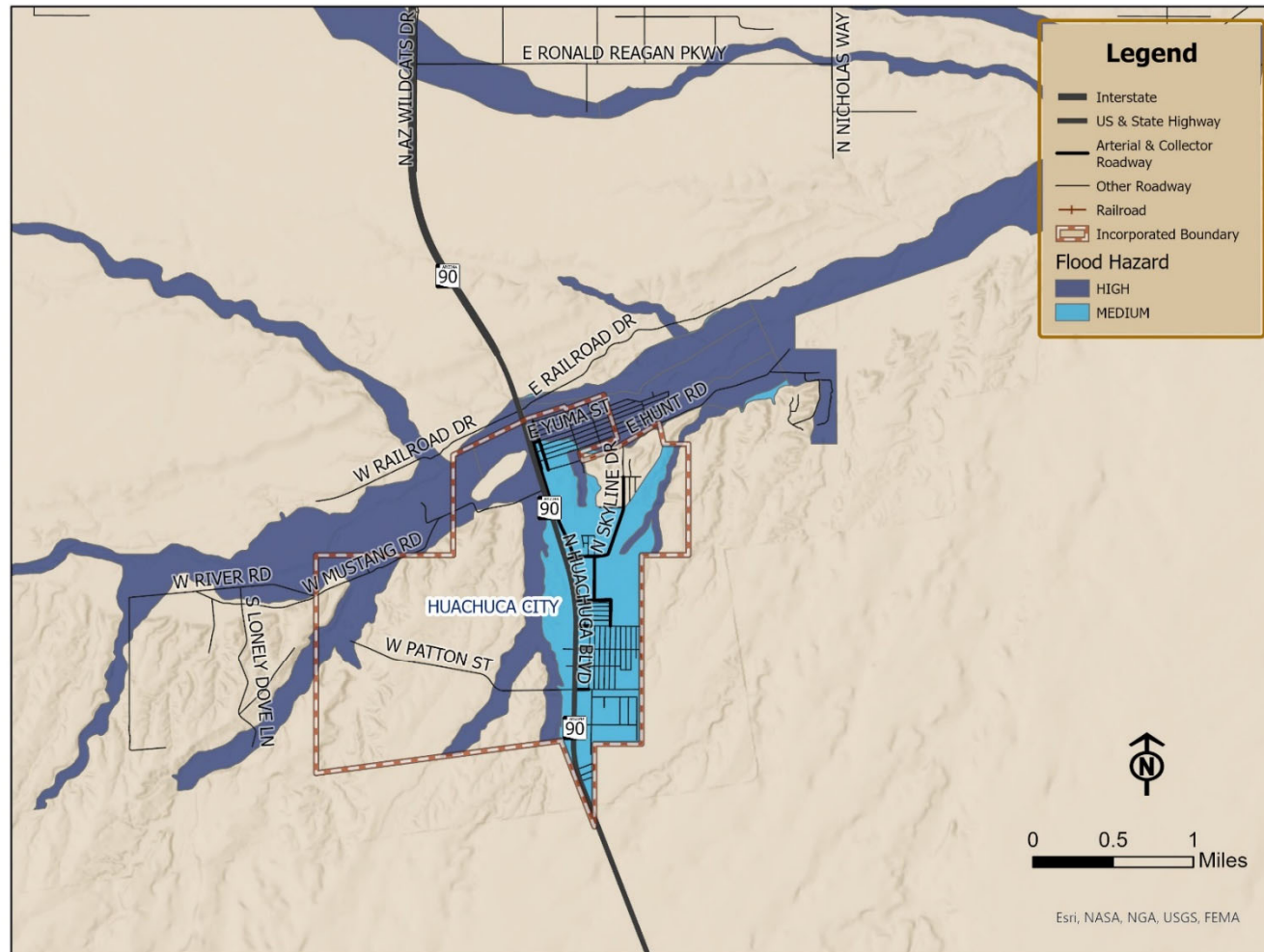


Figure 5.30. City of Douglas Flood Hazard

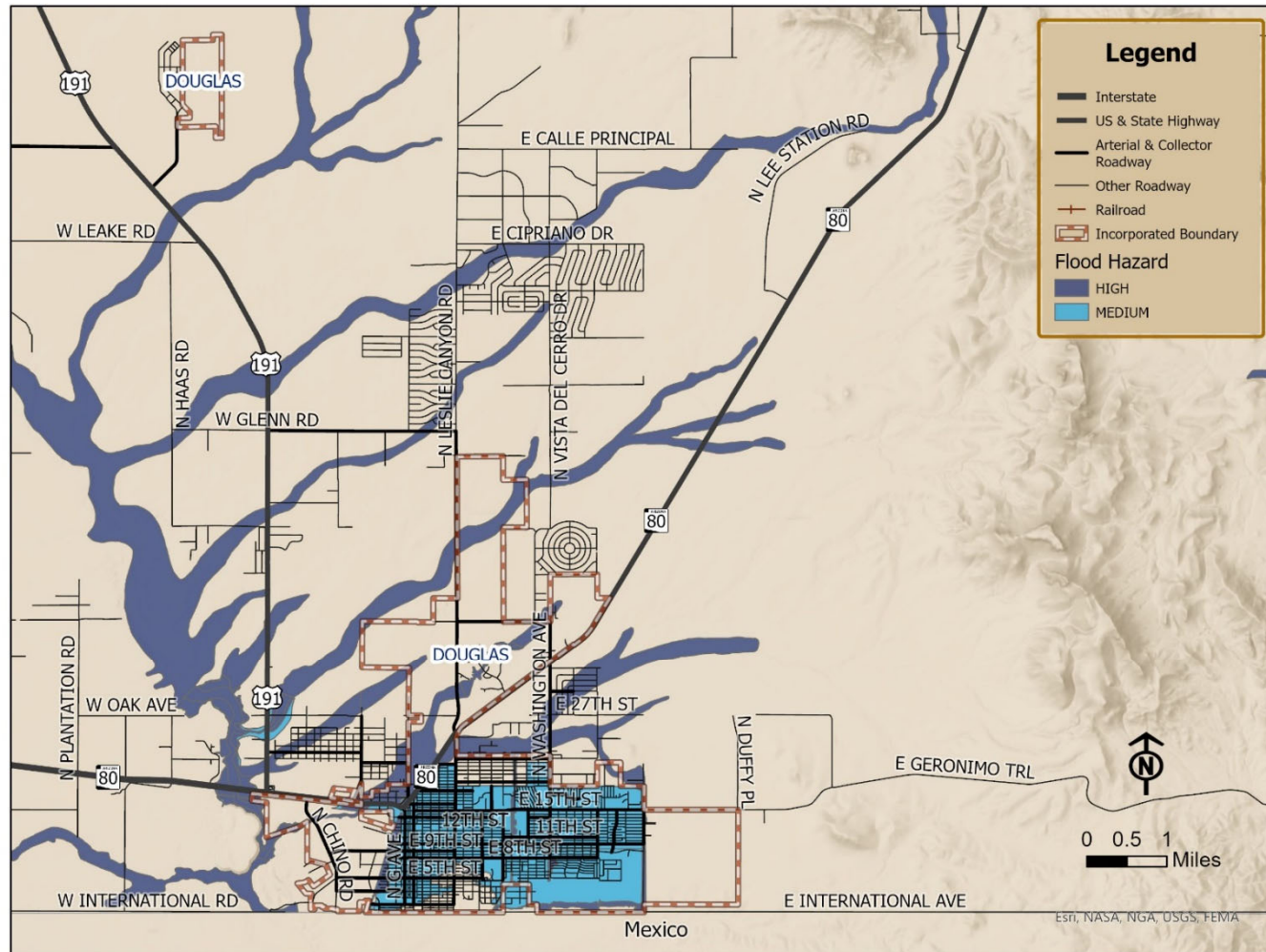


Figure 5.31. City of Bisbee Flood Hazard

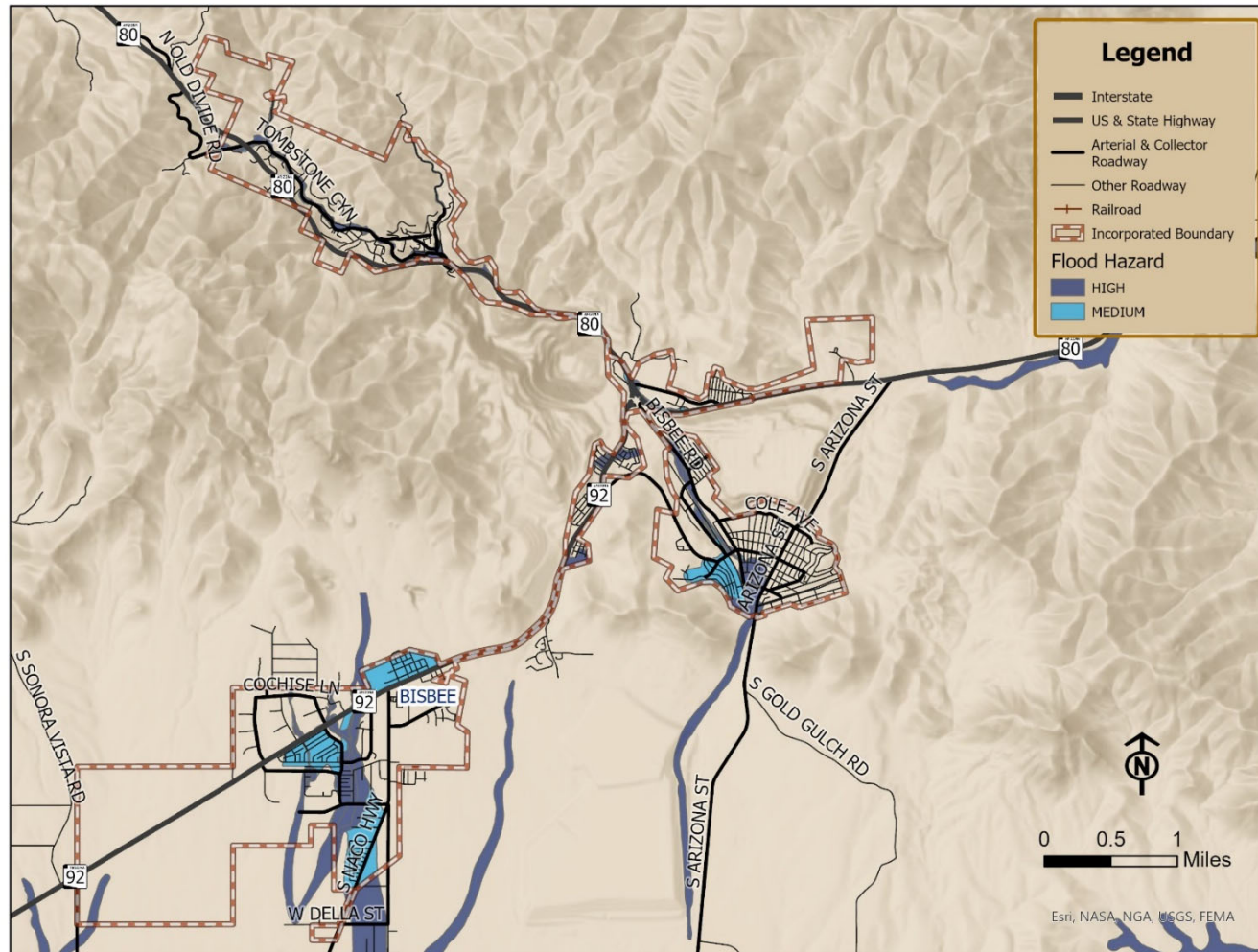
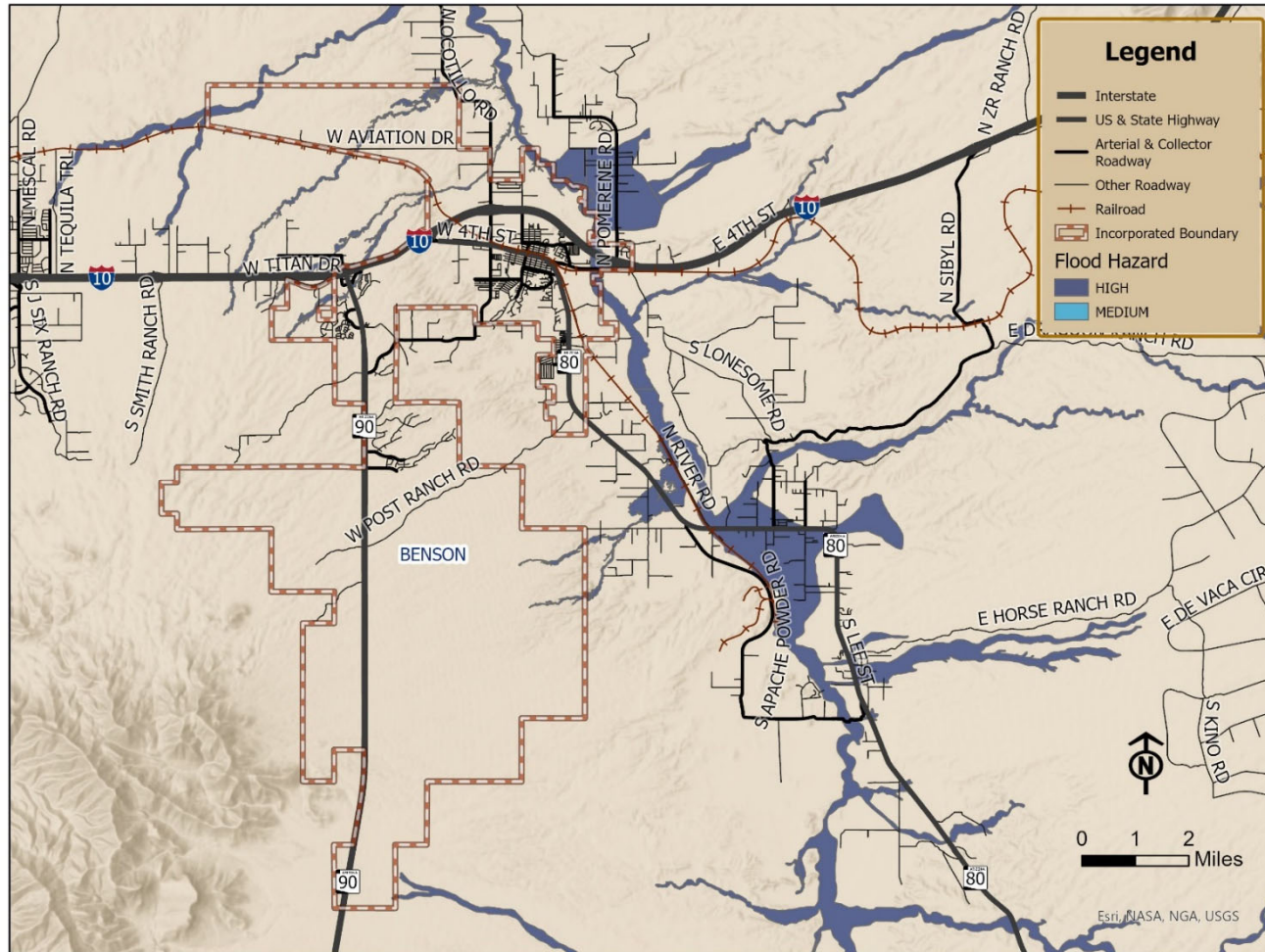




Figure 5.32. City of Benson Flood Hazard



### 5.3.6 Severe Wind

#### Description

The hazard of severe wind encompasses all climatic events that produce damaging winds. For Cochise County, severe winds usually result from extreme pressure gradients that typically occur in the spring and early summer months or thunderstorms throughout the year. Thunderstorms can occur year-round and are generally associated with cold fronts in the winter, monsoon activity in the summer, and tropical storms in the late summer or early fall. Three types of damaging wind-related features typically accompany a thunderstorm, including downbursts, straight-line winds, and tornadoes.<sup>52</sup>

Downbursts are columns of air moving rapidly downward through a thunderstorm. When the air reaches the ground, it spreads in all directions, creating horizontal wind gusts up to 80 mph or higher. Downburst winds have been measured as high as 140 mph. Some of the air curls back upward, potentially generating a new thunderstorm cell. Downbursts are called macrobursts when the diameter is greater than 2.5 miles, and microbursts when the diameter is 2.5 miles or less. They can be either dry or wet downbursts, where the wet downburst contains precipitation that continues down to the ground. In contrast, the precipitation in a dry downburst evaporates on the way to the ground, decreasing the air temperature and increasing the air speed.

In a microburst, the wind speeds are highest near the location where the downdraft reaches the surface and are reduced as they move outward due to the friction of objects at the surface. Typical damage from downbursts includes uprooted trees, downed power lines, mobile homes knocked off their foundations, block walls and fences blown down, and porches and awnings blown off houses.

Straight-line winds are developed similar to downbursts but are usually sustained for greater periods as a thunderstorm reaches the mature stage, traveling parallel to the ground surface at speeds exceeding 50-60 miles per hour. These winds are frequently responsible for generating dust and sand storms, reducing visibility, and creating hazardous driving conditions.<sup>53</sup>

A tornado is a rapidly rotating column of air that extends toward the ground from a thunderstorm (National Severe Storms Laboratory, n.d.). Most funnel clouds do not touch the ground, but when the lower tip of the funnel cloud touches the earth, it becomes a tornado and can cause extensive damage. For Cochise County, tornadoes are the least common severe wind accompanying a thunderstorm. They may also be described as land spouts.

Dust devils<sup>54</sup> are not tornadoes as they develop due to strong surface heating and are much less intense than a tornado. They can grow from the surface to reach thousands of feet in the air and pick up large amounts of dust and debris. Winds can reach up to 60 miles per hour in a dust devil. They are included here since they often damage small structures or loose roofs and are a familiar sight in Cochise County.

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<sup>52</sup> Arizona Department of Emergency and Military Affairs. (2018). *State of Arizona Hazard Mitigation Plan*. (D. P. Branch, Ed.) Retrieved November 5, 2022, from [https://dema.az.gov/sites/default/files/publications/EM-PLN\\_State\\_Mit\\_Plan\\_2018.pdf](https://dema.az.gov/sites/default/files/publications/EM-PLN_State_Mit_Plan_2018.pdf)

<sup>53</sup> National Severe Storms Laboratory. (n.d.). *Severe Weather 101 - Tornadoes*. Retrieved November 5, 2022, from <https://www.nssl.noaa.gov/education/svrwx101/tornadoes/>

<sup>54</sup> National Weather Service. (n.d.). *Dust Devils in Northern Arizona*. Retrieved November 5, 2022, from <https://www.weather.gov/fgz/DustDevil>



## History

Historically, only one declared severe wind event has been recorded for Cochise County. In reality, strong winds are a way of life for most areas of the County, and severe wind events frequently occur, especially during the spring and early summer months. These events do not always have reported damages, however. For example, from 1950 to October 2022, there were 245 recorded events for a search, including dust devil, dust storm, funnel cloud, high wind, strong wind, thunderstorm wind, and tornado in the National Centers for Environmental Information (NCEI) database<sup>55</sup>. It is noted that some of these events are reported more than once, so numbers are relative. Recently, the Arizona Department of Transportation has added wind detection devices along Interstate 10 near the San Simon and Bowie areas leading to more reporting of strong wind gusts since the last Plan revision.

In September of 1999, Cochise County was included in a Federal Declaration (FEMA-1304-DR) with Maricopa County for summer monsoon events that caused \$30.3 million in damages from thunderstorms, high winds, and flooding<sup>56</sup>. The following are examples of significant non-declared events that have occurred since the last plan revision taken from the NCEI database:

- From February 2017 to May 2017, there were six recorded dust storm events in eastern Cochise County. The first event resulted from a recently disturbed track of land causing blowing dust across Interstate 10 near San Simon. Over the subsequent months, additional closures, crashes, and injuries occurred. An Arizona Department of Transportation monitoring device recorded 83 miles per hour winds during an incident where a U.S. Postal Service truck was blown over, and the driver and passenger were injured.
- In July 2018, a monsoon thunderstorm knocked down seven power poles along Dragoon Road east of Benson. This storm also produced large hail throughout the area.
- In July 2019, thunderstorm winds knocked down seven power poles near the Kansas Settlement area in the Sulphur Springs Valley. Another storm that same month caused high wind gusts that caused property and power pole damage along Larson and Moson Roads in Sierra Vista.
- In August 2019, widespread unspecified damage was reported throughout the County due to strong scattered thunderstorms throughout southeastern Arizona. Trees were uprooted, a shed moved off its foundation, a cooler blown off a roof, and a stop sign uprooted in Douglas. A weather station recorded a wind gust of 62 miles per hour. A storm later that month caused the uprooting of trees, damage to structures, and a 73-foot tall antenna to snap near St. David.
- On September 23<sup>rd</sup>, 2019, tropical moisture and an upper-level low caused severe weather in southeastern Arizona. An EF-1 tornado was reported in Willcox near Cox and Hamilton Roads. One mobile home was moved off its foundation, injuring five occupants. Straightline wind damage from the same storm included multiple power poles downed, trees uprooted, and a fifth-wheel trailer toppled with two occupants inside. Both suffered non-life-threatening injuries. Peak wind speeds that day were between 90 and 100 miles per hour.
- In July 2020, isolated and scattered thunderstorms produced wind gusts clocked between

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<sup>55</sup> National Centers for Environmental Information. (2022). *Storm Events Database*. Retrieved September 14, 2022, from <https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=4%2CARIZONA>

<sup>56</sup> Arizona Department of Emergency and Military Affairs. (2022). *Emergency Management: Infrastructure*. Retrieved September 14th, 2022, from DEMA Emergency Declarations 1966 to Present: <https://dema.az.gov/emergency-management/operationscoordination/recovery-branch/infrastructure>

61 and 79 miles per hour. Six power poles were damaged in Sierra Vista near Willcox Road and South Carmichael Avenue. The same storm caused Interstate 10 closures near San Simon and downed trees at the Benson Visitor Center.

- In August 2020, scattered thunderstorms caused strong winds that down tree limbs and damaged a carport, roof, and siding at a residence in Huachuca City.
- In early July 2021, thunderstorm winds downed power poles and damaged or destroyed several storage sheds near Moson Road in Sierra Vista.
- On July 10<sup>th</sup>, 2021, several scattered thunderstorms became severe with damaging winds of 60 to 90 miles per hour that created blowing dust and downed trees and power poles. The most extensive structural damage occurred around Sierra Vista and Fort Huachuca. Winds downed ten power poles between Tombstone and Huachuca City in two different areas. A wind gust at the Pioneer Field of 91 miles per hour was recorded. Near that site, winds destroyed a large reinforced military tent.
- On August 8<sup>th</sup>, 2021, severe scattered thunderstorms developed late afternoon and continued into the next morning. A tree fell on powerlines along Sabin Road in St. David, and four power poles were downed along Dragoon Road.
- On October 11<sup>th</sup>, 2021, high winds buffeted southwest Cochise County during the late night hours into the next morning. Sustained winds over 40 miles per hour and gusts of 50 to 70 miles per hour were measured at several sites. High winds downed or damaged sixteen power poles in Sierra Vista, Fort Huachuca, and Hereford. Damage to roofs, windows, fences, vehicles, and trees was also reported. Downed power lines near Fort Huachuca sparked the Site Maverick Wildfire that consumed over 1800 acres of grassland before containment.
- On February 23<sup>rd</sup>, 2022, an upper-level low system created strong winds in southeastern Arizona. The winds reduced visibility along Interstate 10 from Willcox eastward. The winds also fanned the Hope Fire wildfire that destroyed two homes near the community of Cochise near Apache Way and Quarterhorse Lane. The Arizona Department of Transportation weather station measured wind gusts of 58 to 62 mph along I-10 between Willcox and the New Mexico state line.
- On July 19<sup>th</sup>, 2022, scattered thunderstorms became severe across Cochise and Santa Cruz counties during the late afternoon and evening. A microburst caused extensive damage to homes north of Douglas. The winds downed 42 power poles north of Douglas, forcing the closure of U.S. 191 for 24 hours. More than 40 residences sustained at least minor roof or cosmetic damage, including five mobile homes that either sustained major damage or were destroyed. Three other residences had substantial damage. Most of these were east of Leslie Canyon Drive near Madrone Drive, where a microburst occurred. There were no injuries. Figure 5.33 shows the area of sporadic and concentrated wind damage created by the event. Figures 5.34 And 5.35 are pictures of some of the damage from the event.<sup>57</sup>

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<sup>57</sup> National Weather Service. (2022). *NWS Storm Survey of Douglas Storm Damage July 19th, 2022*. Retrieved September 7th, 2022, from National Weather Service Tucson: <https://www.weather.gov/twc/DouglasMicroburst>

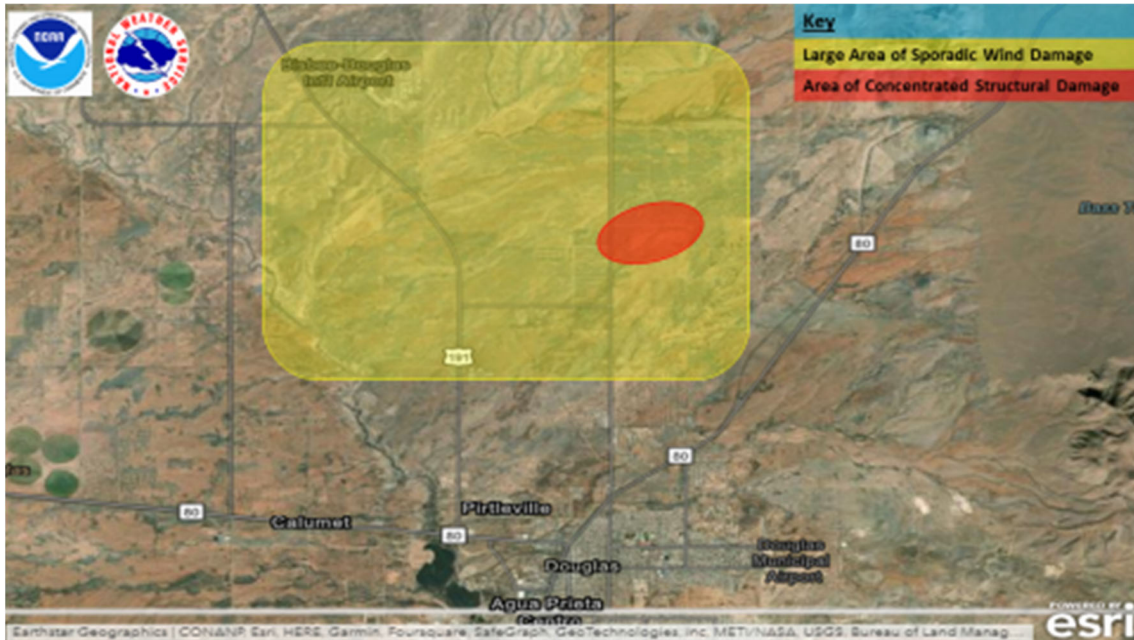


Figure 5.33. Wind Damage Areas North of Douglas, AZ July 19th, 2022

Source: URL: <https://www.weather.gov/twc/DouglasMicroburst>

### Probability and Magnitude

Many severe wind events are associated with summer monsoon thunderstorms. The probability of a severe thunderstorm occurring with high-velocity winds increases as the average duration and number of thunderstorm events increase. The average annual duration of thunderstorms in Cochise County ranges from 60 to 90 minutes. Despite the long duration, the actual number of thunderstorms varies from 50 to 70 per year across the County. The 2022 monsoon season was especially active, and many locations received above-average precipitation. With increased storms come increased chances for strong, damaging wind events.<sup>58</sup>

The National Weather Service (NWS) issues a severe thunderstorm watch when conditions are favorable for developing severe thunderstorms. The local NWS office considers a thunderstorm severe if it produces hail at least 1 inch in diameter, wind of 58 mph or higher, or tornadoes. When a watch is issued for a region, residents are encouraged to continue normal activities but should remain alert for signs of approaching storms. When a severe thunderstorm has been detected by weather radar or reported by trained storm spotters, the local NWS office will issue a severe thunderstorm warning – meaning a storm is imminent or occurring. The information provided by a severe thunderstorm watch may be a couple of hours, while a severe thunderstorm warning typically provides an hour or less warning time.

The American Society of Civil Engineers (ASCE) has identified a 3-second wind gust speed as the most accurate measure for determining the potential for damage to structures and is

<sup>58</sup> Saffell, E. (2022). *Monsoon 2022 (to date!)*. Arizona State University. Arizona State Climatologist. Retrieved November 5th, 2022, from [https://azclimate.asu.edu/files/2022/09/2022monsoon\\_checkin.pdf](https://azclimate.asu.edu/files/2022/09/2022monsoon_checkin.pdf)

recommended as a design standard for wind loading. Most of Arizona and all of Cochise County is designated with a designed 3-second gust wind speed of 90 mph, indicating relatively low levels of risk from severe winds<sup>59</sup>.

Likewise, FEMA identifies most of the County to be in design wind speed Zone I, as illustrated in Figure 5.36 In this zone, a design wind speed of 130 mph is recommended for designing and constructing community shelters.



Figure 5.35. Damage from Wind Event July 19, 2022

Source: URL: <https://www.weather.gov/twc/DouglasMicroburst>



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<sup>59</sup> American Society of Civil Engineers. (2013). *Minimum Design Loads for Buildings and Other Structures*. ASCE Press. Retrieved from <https://ascelibrary.org/doi/book/10.1061/9780784412916>



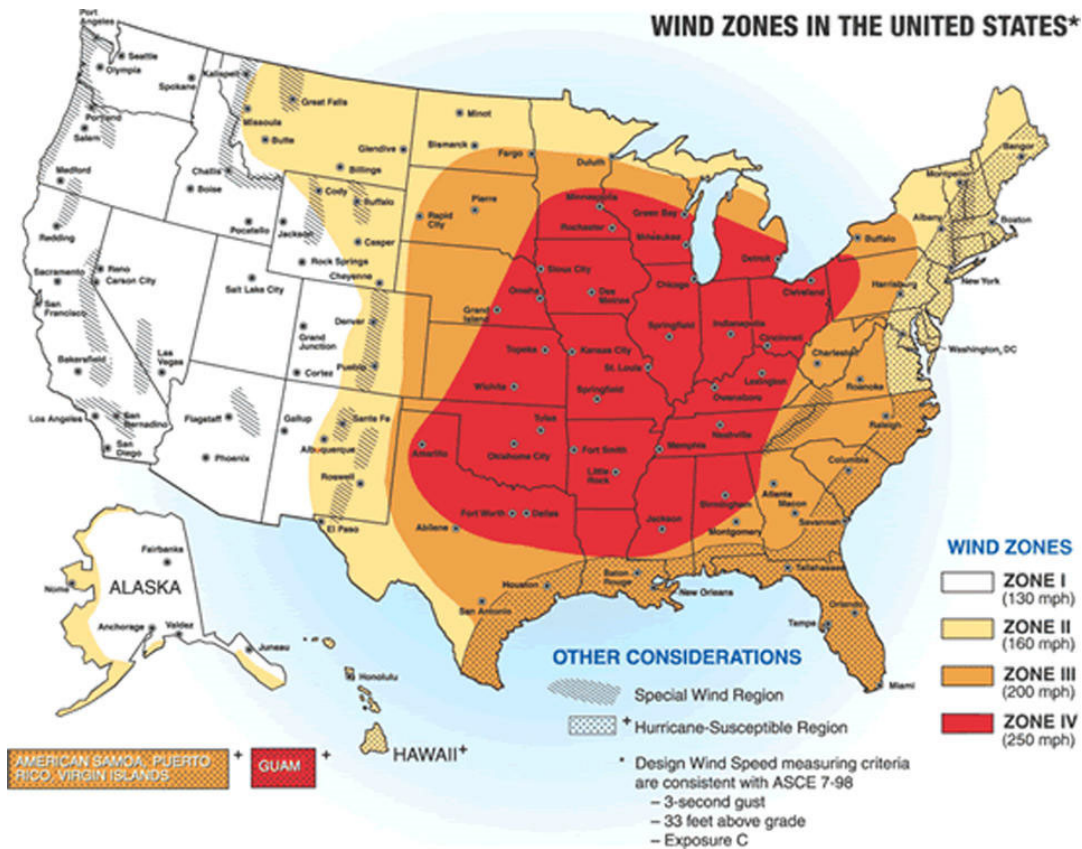


Figure 5.36. Illustration of FEMA Wind Zones

Source: URL: <https://www.nist.gov/image/windzonemap.jpg>

Per the National Risk Index database<sup>60</sup>, Cochise County is rated "Relatively Low" for Strong Wind with a score of 12.85. Tornado is "Very Low," with a score of 7.19. There is no calculated risk index for dust events, but strong winds or microbursts generally cause them. The Enhanced Fujita Scale measures tornado damage severity. The EF-Scale measures tornado strength and associated damages and classifies tornadoes into six intensity categories. For the tornado/funnel cloud/landspout activity historically in the County, most have been rated EF0 or EF1, as in Figure 5.37. This scale considers how most structures are designed and is thought to be a much more accurate representation of the surface wind speeds for most tornadoes. Tornadoes are usually short-lived, but some last for over an hour. The path of a tornado can range from a few hundred feet to miles. The width of a tornado may range from tens of yards to more than a quarter of a mile.

<sup>60</sup> Federal Emergency Management Agency. (2022). National Risk Index. Retrieved July 7th, 2022, from <https://hazards.fema.gov/nri/map#>

EF SCALE	
EF Rating	3 Second Gust (mph)
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

**Figure 5.37.** Enhanced Fujita (EF) Scale

Source: <https://www.weather.gov/oun/efscale>

#### Extent

High winds, often accompanying severe thunderstorms, can cause significant property damage, threaten public safety, and have adverse economic impacts from business and road closures and power loss. Windstorms in the planning area are rarely life-threatening but disrupt daily activities, cause damage to structures, and increase the potential for other hazards, such as wildfire. There are areas throughout the planning area where modular or RV residences are especially vulnerable. Strong thunderstorm winds can start a dust storm which usually arrives suddenly in the form of an advancing wall of dust and debris, which may be miles long and several thousand feet high, or is of the straight line variety where they stay in place for hours over an area of disturbed soils. They strike with little warning and can drastically reduce visibility, making driving conditions hazardous. Dust storms usually last only a few minutes, and the blinding, choking dust can quickly reduce visibility, causing collisions that may involve chain reactions, creating massive pileups.

#### Vulnerability – CPRI Results

Severe Wind CPRI results for each community are summarized in the following table:

Table 5.19. CPRI Results by Jurisdiction for Severe Wind					
Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Benson	3.00	3.00	2.00	2.00	2.75
Bisbee	3.00	2.50	2.25	2.25	2.66
Douglas	4.00	2.00	2.00	3.00	3.00
Huachuca City	3.00	3.50	3.00	2.50	3.10
Sierra Vista	4.00	2.00	4.00	1.00	3.10
Tombstone	2.00	2.00	3.00	2.50	2.20
Willcox	1.00	1.25	0.75	0.25	0.96
Unincorporated County	3.50	2.25	2.50	2.50	2.88
County-wide average CPRI =					2.56

Based on the CPRI Evaluation, the Huachuca City, Sierra Vista, Douglas, and unincorporated parts of the County are perceived to be most at risk from a Severe Wind event. As demonstrated in the table above, the probability of this event occurring in these jurisdictions is thought to be more likely, and the magnitude of impacts more severe. The active 2022 monsoon season caused several damaging events throughout the County, so this hazard is fresh in the Team's minds.

#### Vulnerability – Loss Estimations

The entire County is assumed to be equally exposed to the damage risks associated with severe winds. Over the last five years, it has been noted that funnel clouds, landspouts, and tornado sightings are primarily around the Willcox to St. David area. Strong wind damage Incidents are typically localized, and damages associated with individual events are usually minor unless the event occurs within a densely populated area or area with vulnerable structures like modular/mobile homes or RVs. According to the NCEI database, no fatalities were attributed from 1956 to 2022, but these events showed 13 injuries, 4.267 million in property damage, and 5.0 thousand in crop damage. However, numerous injuries have been reported, either from vehicle collisions, movement of structures off their foundations, or toppling of occupied vehicles.

Estimates of losses for individual jurisdictions are incomplete due to the lack of discrete data. However, according to the Cochise County Office of Emergency Management, the Douglas July 19th, 2022 primary incident surveys show damages over \$900,000. Bisbee estimated roof damage as their major damage vulnerability. They estimated the cost for repairs at \$5000 per roof. With over 500 historic homes, the costs could add up. They were also concerned about the damage to cultural and historical assets.

#### Vulnerability – Development Trend Analysis

Future development within the County will remain vulnerable to strong wind hazards and can increase residents' exposure. Many jurisdictions felt it was important to revisit building codes and development plans to reduce exposures. The damage from winds is often to older or less sturdy structures, so public awareness is one aspect that may help reduce future losses. Future infrastructure development should include wind-resistant or underground utilities to reduce the likelihood of damage. Updating, enforcing, and implementing current building codes to regulate new developments and public education on preparing for severe wind conditions are arguably the best way to mitigate losses.

Douglas will continue to encourage strapping and tie-downs for outbuildings and ancillary structures such as sheds and awnings. Enforcement of tie-down procedures for mobile homes and other building types will be strengthened through Code and Building Inspection Enforcement. Derelict commercial buildings and residential properties will be inspected with corrective action to be taken by the property owner or the City's Abatement program. Huachuca City felt there was moderate risk to property and risk of falling limbs and trees. Sierra Vista experiences minor issues when winds reach over 50 miles per hour, such as uprooted trees, damage to above-ground utilities, and occasional structure damage.



### 5.3.7 Wildfire

#### Description

A wildfire is an uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures. They often begin unnoticed, spread quickly, and are signaled by dense smoke. Wildfires can be human-caused through arson, unattended campfires, improperly burning debris, or even an errant cigarette butt. Naturally sparked wildfires are usually caused by lightning.

Wildfires can be categorized into four types:

- *Wildland fires* occur mainly in areas under federal control, such as national forests and parks, and are fueled primarily by natural vegetation. Generally, development in these areas is nonexistent, except for roads, railroads, power lines, and similar features.
- *Interface or intermix fires* occur where vegetation and structures provide fuel. These are also referred to as urban-wildland interface (WUI) fires.
- *Firestorms* occur during extreme weather (e.g., high temperatures, low humidity, and high winds) with such intensity that fire suppression is virtually impossible. These events typically burn until the conditions change or the fuel is exhausted.
- *Prescribed fires and prescribed natural fires* are intentionally set or natural fires that are allowed to burn for beneficial purposes.

The following three factors contribute significantly to wildfire behavior and, as detailed more fully later, can be used to identify wildfire hazard areas:

- *Topography:* As the slope increases, the rate of wildfire spread increases. South-facing slopes are also subject to greater solar radiation, making them drier and thereby intensifying wildfire behavior. However, ridgetops may mark the end of wildfire spread since fire spreads more slowly or may even be unable to spread downhill.
- *Fuel:* Wildfires spread on the type and quantity of available flammable material, referred to as the fuel load. The basic fuel characteristics include size, shape, arrangement, and moisture content. Each fuel is assigned a burn index (the estimated amount of potential energy released during a fire), an estimate of the effort required to contain a wildfire, and an expected flame length.
- *Weather:* The most variable factor affecting wildfire behavior is the weather. Important weather variables are temperature, humidity, wind, and lightning. Weather events ranging in scale from localized thunderstorms to large fronts can majorly affect wildfire occurrence and behavior. Extreme weather, such as high temperatures and low humidity, can lead to intense wildfire activity. By contrast, cooling and higher humidity often signal reduced wildfire occurrence and easier containment. The wind has probably the largest impact on a wildfire's behavior and is also the most unpredictable. Winds supply the fire with additional oxygen, further dry potential fuel, and push the fire across the land quicker.

The frequency and severity of wildfires are also impacted by other hazards, such as lightning, drought, and infestations (e.g., Pine Bark Beetle, Salt Cedar, and Buffelgrass). In Arizona, these hazards combine with the three other wildfire contributors noted above (topography, fuel, weather) to present an ongoing and significant risk across much of Arizona.

If not promptly controlled, wildfires may grow into an emergency or disaster. Even small fires can threaten lives, resources, and properties. Wildfires may severely affect livestock and pets. Livestock may require emergency watering, feeding, shelter, evacuation, and mortuary services. Wildfires can damage or destroy natural resources vital for recreation and tourism.

The indirect effects of wildfires can also be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance the siltation of rivers and streams, harming aquatic life, and degrading water quality. Lands stripped of vegetation are also subject to increased landslide hazards. Without vegetation, soils may be unable to hold or absorb water, worsening flood conditions.

### History

Before the 2017 Plan update, there were two large fires in the wildland-urban interface (WUI) since the early 2000s of note. The Horseshoe 2 Fire and the Monument Fire are described below. Cochise County's Wildfire Protection Plan (CCWPP) has not been updated since 2014. It contains an extensive history of the County's wildfires before 2014.

- Horseshoe Two Fire – On May 8, 2011, the Horseshoe 2 Fire was ignited by human causes and burned 222,954 acres within the Chiricahua Mountains of Southeastern Arizona. Twenty-three structures were destroyed, and at least \$51.1 million in fire suppression costs were estimated. The fire was finally fully contained on June 25, 2011.<sup>61</sup>
- Monument Fire – On June 12, 2011, the Monument Fire burned 32,074 acres in an area located four miles east of Hereford, Arizona. Forty-four homes and 17 other buildings were damaged or destroyed in the Ash Canyon area. Seven houses and four other structures were destroyed in the Stump Canyon area. Authorities estimated that approximately 3,000 homes and 12,000 people were evacuated. Post-fire flooding from the burned watersheds also destroyed the City of Tombstone's water catchment structures on 24 springs in Carr and Miller Canyons, with damages estimated at over \$30,000 and the possibility of a severe shortage in water supply until the springs are restored. The fire was declared 98% contained on July 6, 2011, and the fire suppression costs were estimated to exceed \$20.35 million.<sup>62</sup>

Information on the following fires of note since 2017 was retrieved from the NCEI Storm Events Database<sup>63</sup>.

- The lightning-caused Lizard Fire started on June 7, 2017, in the Dragoon Mountains and quickly spread due to strong winds. The fire merged with the Dragoon Fire, which caused an increase in acreage to 15,238 acres. The communities of Dragoon and Cochise Stronghold were evacuated. One home and two outbuildings were destroyed in Dragoon. The fire continued into July before it was fully contained on July 19.
- On June 7, 2017, the lightning-caused Bowie Fire started on the northwest side of the Chiricahua Mountains near Fort Bowie and was spread by gusty winds. The Fort Bowie National Historic Site was closed due to the fire, and the Diamond Mountain Retreat Center was evacuated. A total of 3,036 acres burned before containment on July 14.

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<sup>61</sup> National Park Service. (2018, October 6). *Horseshoe Two Fire - 2011*. Retrieved November 6, 2022, from Chiricahua National Monument Arizona: <https://www.nps.gov/chir/learn/nature/horseshoe-two-fire-2011.htm>

<sup>62</sup> JE Fuller. (2017). *Cochise County Multi-Jurisdictional Hazard Mitigation Plan*. Retrieved November 6, 2022, from <https://www.cochise.az.gov/DocumentCenter/View/495/Cochise-County-Multi-Jurisdictional-Hazard-Mitigation-Plan-2017-PDF>

<sup>63</sup> National Centers for Environmental Information. (2022). *Storm Events Database*. Retrieved September 14, 2022, from <https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=4%2CARIZONA>

- The Swisshelms Fire started June 27, 2017, possibly due to spotting from the smaller Saddle Fire, which was ongoing to its south. The Swisshelms Fire quickly spread due to strong winds and was not fully contained until July 10, after 10,950 acres had been burned.
- On April 2, 2018, the human-caused Adobe Fire started in southeast Cochise County and quickly spread through 261 acres of grass and dry brush by gusty winds. Ten residents were evacuated, and several roads were closed after the onset of the fire due to the threat to nearby structures. A small shed and a larger barn were lost as the fire jumped Double Adobe Road, but no injuries occurred. The fire was largely contained after dark that evening but was not fully contained until April 4.
- On May 12, 2018, the human-caused Pinery fire started on private land, then spread rapidly up the terrain to the Chiricahua National Monument and Coronado National Forest in the Chiricahua Mountains. The fire slowed as it reached higher and rocky terrain in the footprint of the 2011 Horseshoe 2 Fire. The fire consumed 1200 acres before containment was achieved on May 24. The national monument was evacuated and closed for several days, but the fire damaged no structures.
- On June 7, 2018, the Judd Fire was started by lightning and was contained on June 14. The fire burned 4,214 acres of scrub oak, brush, and grass on the Mule Mountains.
- On July 24, 2018, lightning ignited the Bruno Fire just east of Leslie Canyon Wildlife Refuge. The fire spread into the Pedrogosa Mountains and burned 4447 acres before becoming contained on July 31. Lightning also sparked the 600-acre Howard Fire in the Dos Cabezas Mountains on the same day and the 1700-acre Winchester Fire in the Winchester Mountains on July 25.
- Lightning started the Emigrant Fire on June 5, 2020, in the Chiricahua. The fire consumed 4756 acres before becoming fully contained on June 14. Fire suppression costs were estimated at \$800,000.
- On August 10, 2020, lightning started the Klaus Fire in the Chiricahua Mountains in southeast Cochise County. The fire was spread by strong winds and a lack of monsoon rainfall and consumed 4864 acres before becoming contained on August 18. Fire suppression costs tallied \$377,500.
- The human-caused Jack Fire started on April 21, 2021, in the Chiricahua Mountains. Forward progress was stopped on April 25, and the fire was contained on April 28, with a total of 1856 acres consumed. Fire suppression costs tallied just over \$2 million.
- On May 25, 2021, the human-caused Warren Fire started in the Chiricahua Mountains. The wildfire grew to 1400 acres by May 29 in hot and dry conditions. No fire growth was experienced after this date, but the fire was not officially contained until June 5. Fire suppression costs tallied over \$3 million.
- In the Little Dragoon Mountains, the lightning-caused Walnut Fire started on June 20, 2021. The wildfire grew rapidly to nearly 7000 acres in hot, dry, and occasionally windy conditions by June 22, jumping Interstate 10 and prompting its closure and the evacuation of several residences and businesses in the Texas Canyon and Dragoon areas. Rain on June 23 helped slow the fire's spread, and additional rain on the 28th quashed the fire after it consumed a total of 10,667 acres. Fire suppression costs tallied \$1.4 million.
- On February 23, 2022, the Hope Fire burned 25 acres of grass and brush fueled by winds over 50 miles per hour from an upper-level low-pressure system moving along the Great Basin. One house and one mobile home were destroyed by the fire in the community of Cochise near the intersection of Apache Way and Quarterhorse Lane. This incident is also mentioned in the Strong Wind hazard.

- The Camino Fire started on April 20, 2022, near Sunizona due to a vehicle dragging tow chains on the road. 45-mile-per-hour wind gusts drove the fire. Around 40 residences were evacuated, State Route 181 was closed, and approximately 750 acres were burned. Fire suppression costs were \$600,000.
- The lightning-caused Raspberry Fire started on June 14, 2022, in the Chiricahua Mountains. Thunderstorm wind gusts of 30 miles per hour helped the fire to quickly grow in mountainous terrain to more than 400 acres. The fire became fully contained on June 25, aided by several days of rainfall. Fire suppression costs for fire tallied just short of \$1 million.

#### Probability and Magnitude

The probability and magnitude of wildfire incidents for Cochise County are influenced by numerous factors, including vegetation densities, previous burn history, hydrologic conditions, climatic conditions such as temperature, humidity, and wind, ignition source (human or natural), topographic aspect and slope, and remoteness of the area.

In 2014, Cochise County collaborated with various cooperating stakeholders to prepare the Cochise County Wildfire Protection Plan (CWPP)<sup>64</sup>, which discusses Wildland Urban Interface (WUI) areas and wildfire risk elements. The CWPP wildfire analysis records participating communities' WUI risk ratings, as seen in the recommended at-risk communities Table 5.20. The CWPP will be updated in 2023.

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<sup>64</sup> National Park Service. (2018, October 6). *Horseshoe Two Fire - 2011*. Retrieved November 6, 2022, from Chiricahua National Monument Arizona: <https://www.nps.gov/chir/learn/nature/horseshoe-two-fire-2011.htm>

Table 5.20. CWPP Wildfire Risk Analysis			
Community WUI	WUI Risk	Communities within WUI	Fire Dept/Dist
Benson	Low	Benson	Benson Fire Department
Bisbee	From Bisbee CWPP: 37% High 34% Moderate 29% Low	Bisbee Banning Creek, Highland Creek, Naco, South Bisbee, Warren	Bisbee Fire Dept., Naco Fire Dist., San Jose Fire Dist.
Douglas/Sunnyside	Moderate	Calumet, Douglas, Pirtleville, Sunnyside	Douglas Fire Dept., Sunnyside Fire Dist., Pirtleville Fire Dist.
Town of Huachuca City	Low	Campstone, Huachuca City, Whetstone	Huachuca City Fire Dept., Whetstone Fire Dept., PBW Fire Dist.
Sierra Vista/Palominas	Moderate	Bledsoe, Hereford, Miracle Valley, Nicksville, Palominas, Ramsey, Sierra Vista, Sierra Vista Southeast, Stark	Sierra Vista Fire Dept., Fry Fire Dist., Palominas Fire Dist.
Willcox	Moderate	Willcox	Willcox Fire Dept.

The following Figure 5.38 displays the results of the cumulative risk analysis, which was conducted for the Cochise County CWPP. The risk analysis identifies areas and relative percentages of high, moderate, and low WUI areas. It synthesizes the risks associated with fuel hazards, wildfire ignitions, wildfire occurrence, and community values. Map 5.39 displays the established WUI boundaries, Fire Districts, and Land Ownership areas for the entirety of Cochise County in the 2014 Cochise County CWPP.

**Cochise County Community Wildfire Protection Plan**

**Cumulative Risk**

- Low
- Moderate
- High
- WUI Boundary
- Cochise County

Miles 0 5 10



**Cochise County Community Wildfire Protection Plan**

**WUIs, Fire Districts and Land Ownership**

- WUI Boundary
- Fire Districts
- Cochise County
- Bureau of Land Management
- Coronado National Forest
- State Trust Land
- State Parks
- National Monuments/Historic Sites
- Military
- Arizona Game and Fish
- San Bernardino National Wildlife Refuge
- Private Land

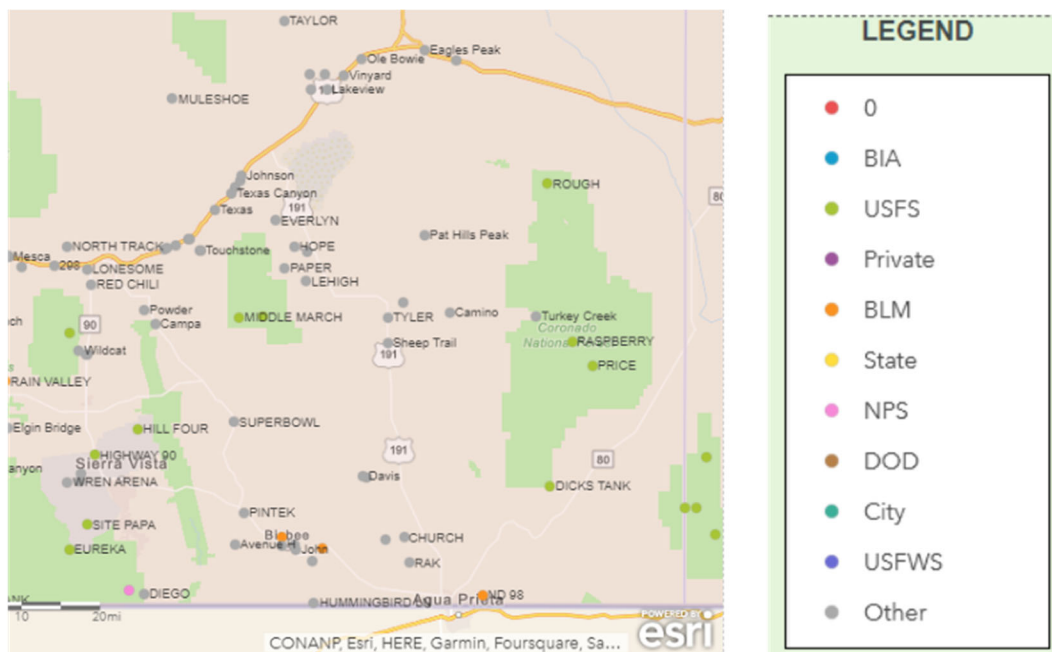
0 5 10 Miles



## Extent

A wildfire's scale and complexity will determine the hazard's extent. As the historical record shows, a wildfire's extent depends on numerous factors, including location, topography, heating, fuel load, etc. The extreme variability of precipitation across the southwest and the trend of increasing temperatures have led to extremely dry conditions within the forest and grasslands of Pima County. These dryer conditions will continue to increase the length and severity of wildfires. As the wildland-urban interface grows, the potential for catastrophic wildfires will also increase. From the maps of wildfire risk below, the greatest fire threat is along transportation routes and in forested and grassland areas. It is unlikely that an event would affect all high-risk areas at one time. Figure 5.40 shows the Southwest Coordination Center Wildland Fire map for the year to date 2022<sup>65</sup>, along with responsible jurisdictions. Note the concentration of fires in urban areas and along roadways. Figures 5.41 through 5.48 at the end of this section show the countywide wildfire risks along with each jurisdiction. Fires between 2000 and to date 2022 are also marked. The risk of fires increases along transportation routes which matches current incident data.

Figure 5.40. Southwest Wildland Fire Map – Year-to-Date Incidents 2022



<sup>65</sup> Southwest Coordination Center. (2022). *SW Wildland Fire Map - Year-To-Date Incidents*. Retrieved November 6, 2022, from [https://gacc.nifc.gov/swcc/predictive/intelligence/daily/YTD/YTD\\_Incident\\_Map.htm](https://gacc.nifc.gov/swcc/predictive/intelligence/daily/YTD/YTD_Incident_Map.htm)

### Vulnerability – CPRI Results

Wildfire CPRI results for each community are summarized in the following table:

Table 5.21. CPRI Results by Jurisdiction for Wildfire					
Participating Jurisdiction	Probability	Magnitude/ Severity	Warning Time	Duration	CPRI Score
Benson	3.00	3.00	2.00	2.00	<b>2.75</b>
Bisbee	4.00	3.00	3.50	3.50	<b>3.58</b>
Douglas	4.00	3.00	4.00	4.00	<b>3.70</b>
Huachuca City	3.00	3.00	4.00	3.00	<b>3.15</b>
Sierra Vista	4.00	2.00	4.00	4.00	<b>3.40</b>
Tombstone	3.00	2.00	2.00	3.00	<b>2.55</b>
Willcox	2.00	1.25	0.75	0.50	<b>1.44</b>
Unincorporated County	3.25	2.75	3.25	3.50	<b>3.13</b>
County-wide average CPRI =					<b>2.99</b>

Based on the CPRI Evaluation, all but Willcox consider wildfire a high risk. It should be noted that almost every jurisdiction feels that a wildfire is highly likely to occur in their community.

According to the FEMA National Risk Index<sup>66</sup>, wildfire is ranked "Relatively High" at a score of 33.09.

The primary risk to the City of Sierra Vista is wildfire entering through washes and other natural landscapes and spreading to nearby buildings. When combined with wind and drought, fire can spread quickly and lead to widescale evacuations and property loss.

In Benson, the spring of 2022 and 2021 both had large wildfires within the city limits. The wildfire in 2021 did not threaten any structures. The one in the spring of 2022 threatened homes to the point where evacuations were being considered.

The City of Bisbee has had many close WUI fires in the last few years. In 2018 the Judd Fire was on the outskirts of Bisbee and grew to around 10,000 acres. That same year, the Zacatecas Fire burned 40 acres in the Bisbee WUI. In April 2022, the Lockland Fire burned in a portion of Old Bisbee and prompted evacuations of about 15 people from the Wood Canyon area, and about 30 more people were on standby. Other areas affected by the Locklin Fire include Juniper Flats, Locklin Avenue, and Star Avenue. The fire was estimated to have burned up to 150 acres. Crews fought the fire to keep it from moving onto Mule Mountain. Another fire that same month caused State Route 80 to

<sup>66</sup> Federal Emergency Management Agency. (2022). National Risk Index. Retrieved July 7, 2022, from <https://hazards.fema.gov/nri/map#>

be closed for hours and pre-evacuations were in place.

The risk of WUI fires in the Town of Huachuca City is significant. The town is surrounded by undeveloped land owned by Ft. Huachuca and the City of Sierra Vista. Although there have been some fuel reduction projects in both areas, hazards to the town continue.

Each year the City of Willcox experiences wildfires within the jurisdiction and responds to events in the unincorporated area surrounding the City. To date, events within the City have not caused excessive damage and have been containable within a short time. Wildfires outside of the incorporated boundaries of the City continue to place strain on Willcox resources. Willcox's management of major events within the area but outside of the incorporated City put pressure on resources and take away from preparedness activities.

#### Vulnerability – Loss Estimations

According to the Insurance Information Institute<sup>67</sup>, Arizona had the third-highest number of burned acres in 2021 and is ranked fourth in the estimated number of properties at risk. The National Risk Index shows expected annual losses for wildfire or \$2.8 million with an exposure of \$66 billion.

The NCEI database show costs of wildfire incidents estimated at \$6 million from 2020 through October 2022 for fires where the estimated costs were shown. It should be noted that most of these dollar amounts may not include the cost of wildfire suppression, which can be substantial. For example, deploying a Type 1 wildland firefight crew costs about \$1 million daily. Depending on the fire location and jurisdiction, the authority having jurisdiction may bear higher costs of fire suppression efforts or through state or federal funding sources. Otherwise, expenses are absorbed by the local agencies and jurisdictions.

Benson feels the potential for damage to assets in the city limits can occur due to the wildland interface occurring in some developments. These developments are set right next to open state land or National Forest. The impact would be costly to property and potentially lives in this WUI.

Historic Old Bisbee is a densely populated mixed residential and commercial district with buildings and homes packed closely along both walls of a narrow and steep canyon. All of Old Bisbee is part of the historic registry. A catastrophic fire would have an immense impact and cost on the historical status. The possibility of fire is high, with a likelihood of entire neighborhoods burning up very rapidly, trapping and engulfing the people who reside there. The current water storage for the fire suppression system is an old (circa 1910), open-air municipal pool that is replenished using a pump from an old well. Some neighborhoods in town are above the grade of the municipal pool, resulting in weak and inconsistent pressures. If large parts of the City were to burn, it would be an economic death blow for the businesses that draw tourist traffic to the community and the community at large. The highest risk for wildfire is in the Old Bisbee district, due to the antique architecture, with a fuel-rich WUI border. Many homes have been abandoned during previous economic downturns after mine closures and are now in varying states of disrepair, creating fuel for fires.

Bisbee anticipates that future conditions will escalate drought and excessive heat, increasing fuel load in the WUI and producing more intense dry lightning storms (storms without rain) to ignite that fuel. All scenarios point to a likelihood of increased risks to life safety, property damage (including loss of historical landmarks and cultural resources), loss of emergency services and utilities, displacement costs, added emergency management costs, social stress/anxiety, loss of productivity, and loss of business income if the problems are not addressed.

There are 4,265 properties in Bisbee that have some risk of being affected by wildfire over the next

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<sup>67</sup> Institute, Insurance Information. (32021). *Facts + Statistics: Wildfires*. Retrieved November 6, 2022, from <https://www.iii.org/fact-statistic/facts-statistics-wildfires>

30 years. This represents 100% of all properties in Bisbee. In addition to damaging properties, wildfire can cut off access to utilities and emergency services and impact evacuation routes.

If a wildfire were to enter City limits and the hydrant system failed, and with a response delay of at least one hour for mutual aid, the town of Old Bisbee could go up in flames. Cost is difficult to evaluate. Historic Bisbee is the economic driver for the City. To rebuild historic structures completely could cost over 100,000,000 million.<sup>68</sup>

Many buildings in Tombstone are late 19th century; hence fire code adherence is lacking, and the construction materials utilized are prone to combustion. Large areas adjacent to the City include grassland, which, when coupled with local wind conditions and a small Fire Department, would fuel a wildfire and potentially rapid expansion. The City of Tombstone is an international tourist destination, and the loss of historic and cultural assets due to fire would devastate the economy and residents. As with Bisbee, the costs to rebuild would be unimaginable.

#### Vulnerability – Development Trend Analysis

By its very definition, the WUI represents the fringe of urban development as it intersects with the natural environment. As previously discussed, wildfire risks are significant for a sizeable portion of the county. Any future development will only increase the WUI areas and expand the potential exposure of structures to wildfire hazards. The Cochise County CWPP addresses mitigation opportunities for WUI areas and provides recommended guidelines for safe building and land-use practices in wildfire hazard areas. It also presents recommendations for enhanced wildland fire protection capabilities, public education, information, and outreach.

Cochise County Emergency Management works with communities and local fire departments sharing information on Firewise communities, mitigation efforts on private properties, and other preparedness activities such as building defensible space. This information is being shared knowing that response times to locations could be extended.

The City of Douglas is actively pursuing annexation opportunities for unincorporated areas to the northeast and west of the existing city limits. Successful annexation will increase established residential and commercial properties and unimproved parcels, increasing the risk/vulnerability due to the WUI. The City will follow established guidelines for safe building and land-use practices in these WUI hazard-prone areas.

With the fire department's assistance, the City of Benson's building department works with developers to create FireWise developments. This includes providing open space away from structures and utilizing building materials less likely to catch fire should a fire occur.

Bisbee is attempting repairs to failing portions of the fire suppression system. The Old Bisbee FireWise 501c3 was organized in 2019. FireWise completed a fuels reduction around most of Old Bisbee. Firewise education and evaluation for personal properties are ongoing. A feasibility study and water master plan were developed through FEMA's advanced assistance funding and specifically discussed the importance of managing the fire suppression system in Old Bisbee to mitigate the risk to the City of Bisbee from wildfire.

In Huachuca City, the responsibility for providing emergency services within the Town of Huachuca City has transferred from the Whetstone Fire District to the Fry Fire District. Services are provided under a three-year contract. Recently fire inspections were completed on all commercial

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<sup>68</sup> First Street Foundation. (n.d.). Wildfire Risk Overview: Does Bisbee Have Risk? *Risk Factor*. Retrieved November 6, 2022, from [https://riskfactor.com/city/bisbee/406260\\_fsid/fire](https://riskfactor.com/city/bisbee/406260_fsid/fire)

occupancies, and the water supply and distribution system were tested.

The past few years have seen some mesquite removal completed on Fort Huachuca near the Sierra Vista Airport and prescribed fire on the East Range of Fort Huachuca to reduce risk in Huachuca City. There have not been any recent developments within the Town proper. However, Huachuca City is exploring hazardous fuel abatement projects, constructing fire breaks, and seeking funding while working towards an updated Cochise County Community Wildfire Protection Plan.

Figure 5.41. County-Wide Wildfire Risk Index

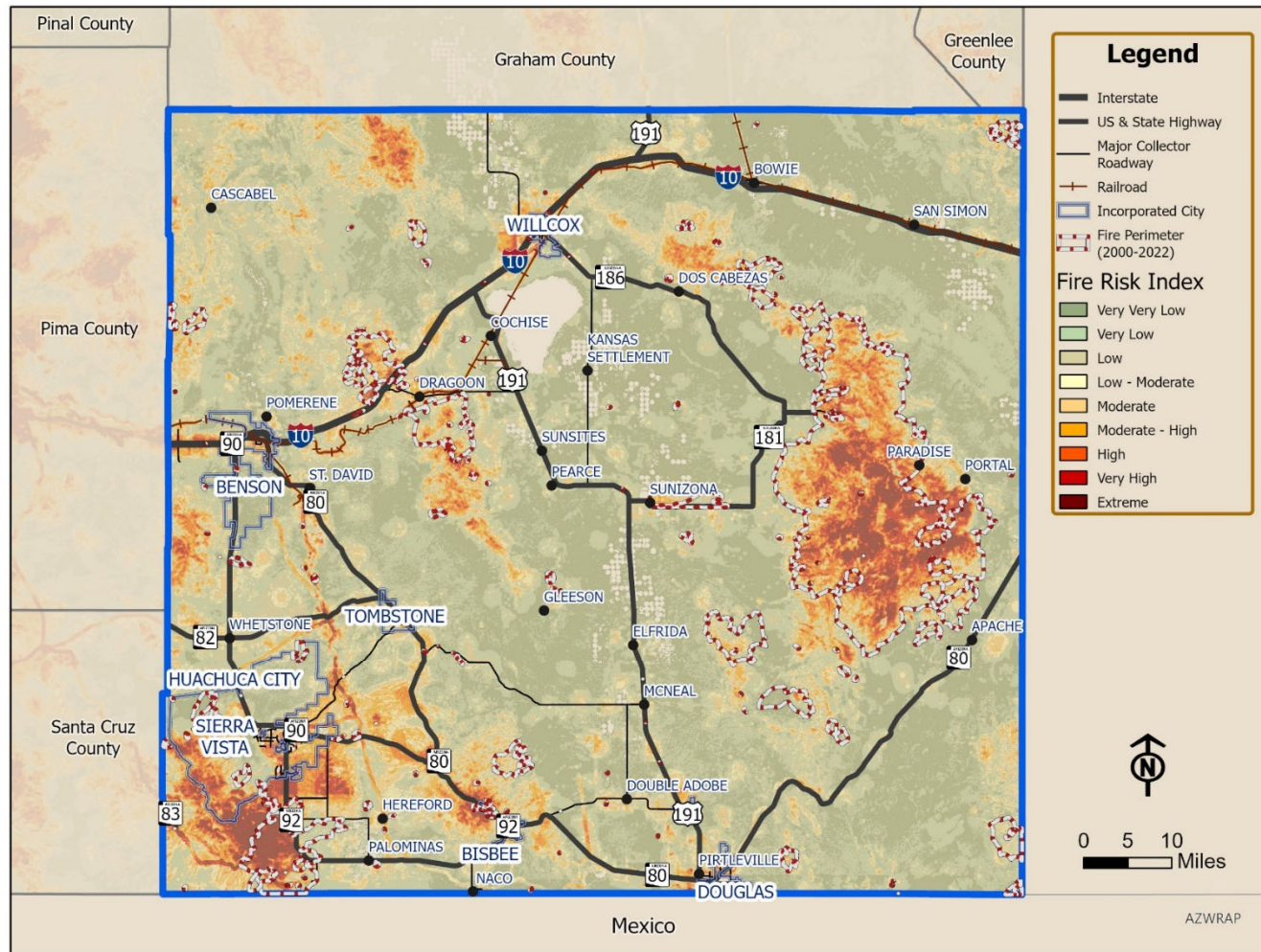




Figure 5.42. City of Benson Wildfire Risks

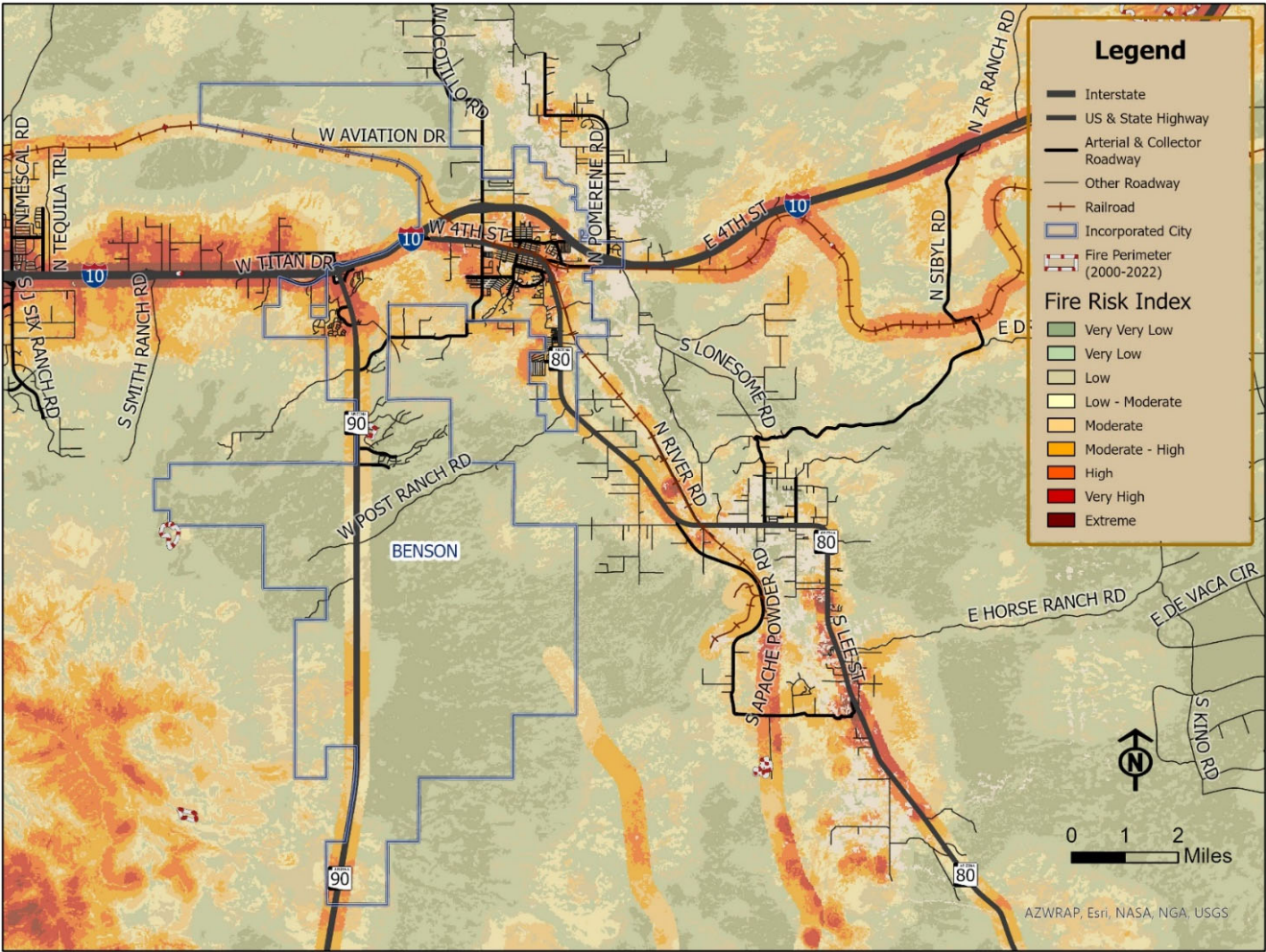




Figure 5.43. City of Bisbee Wildfire Risks

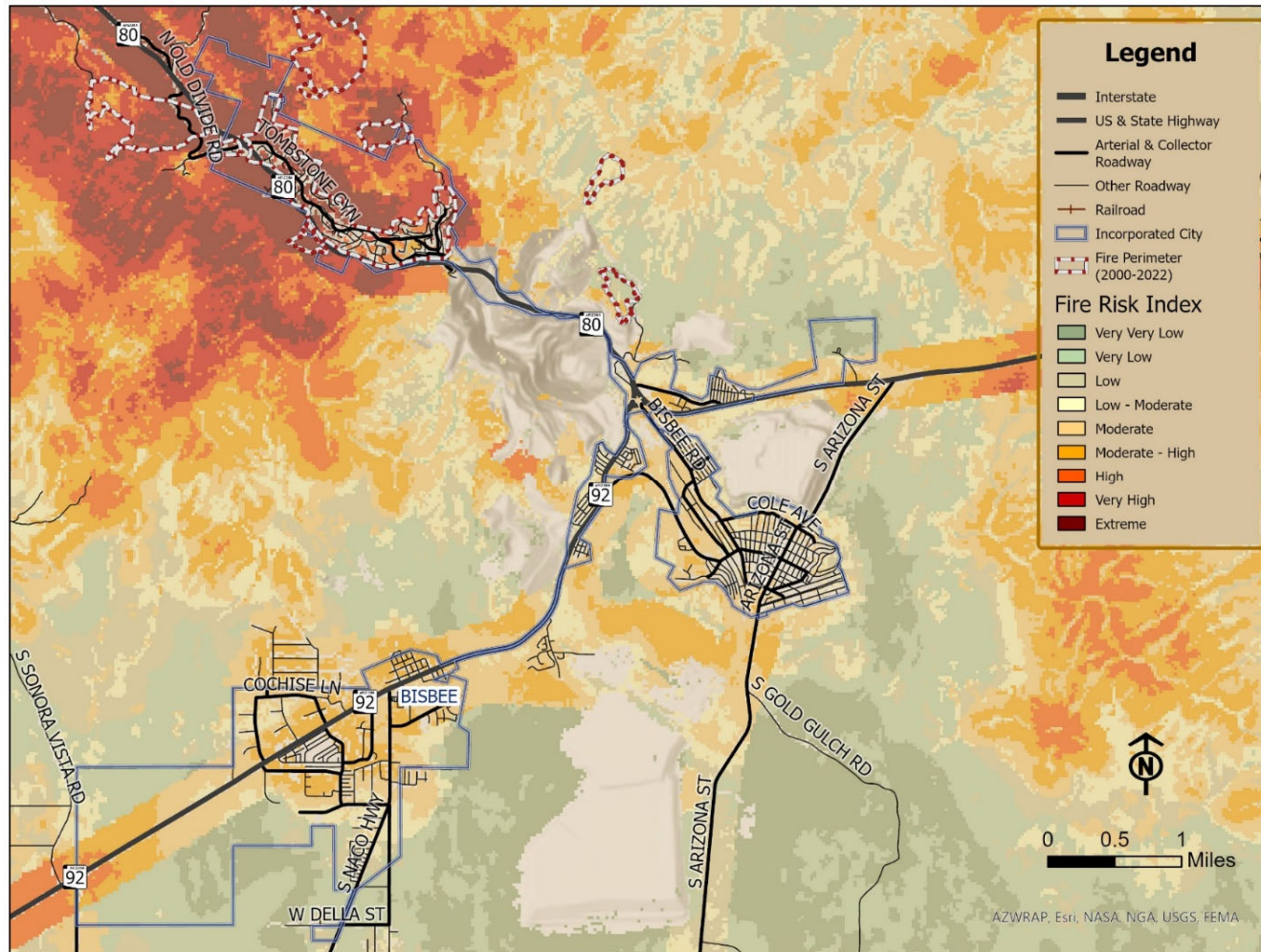


Figure 5.44. City of Douglas Wildfire Risks

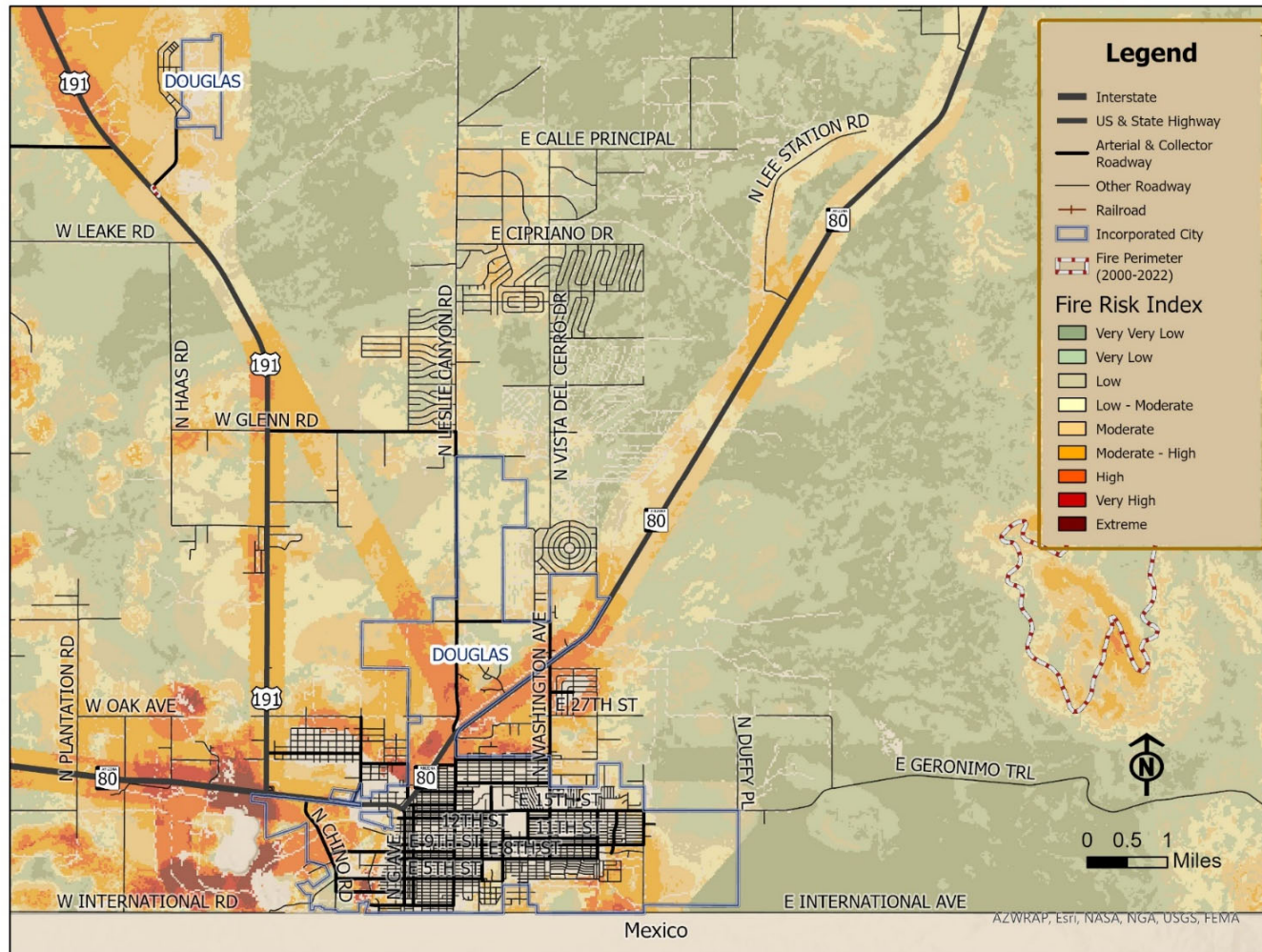




Figure 5.45. Town of Huachuca City Wildfire Risk

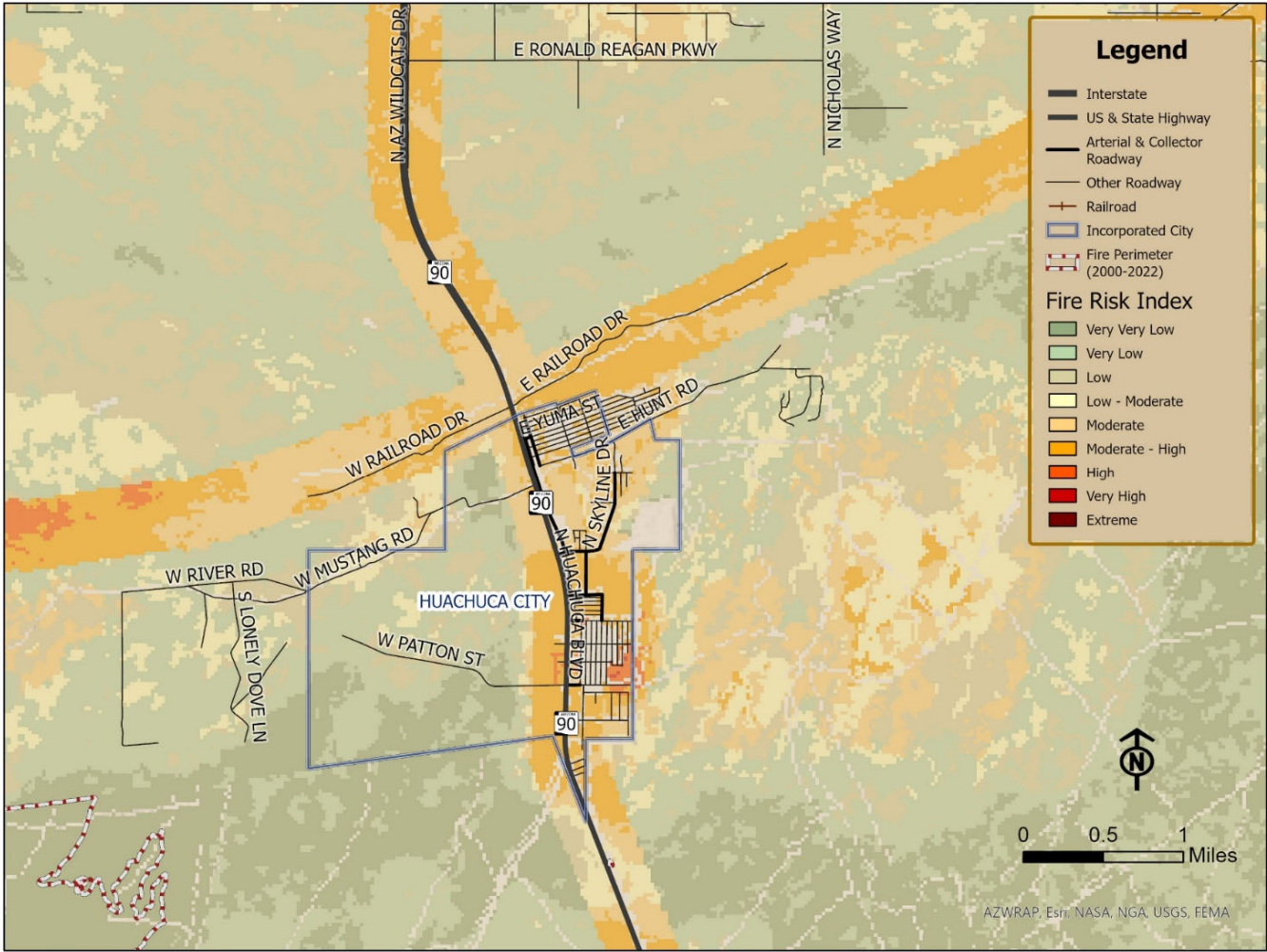


Figure 5.46. City of Sierra Vista Wildfire Risks

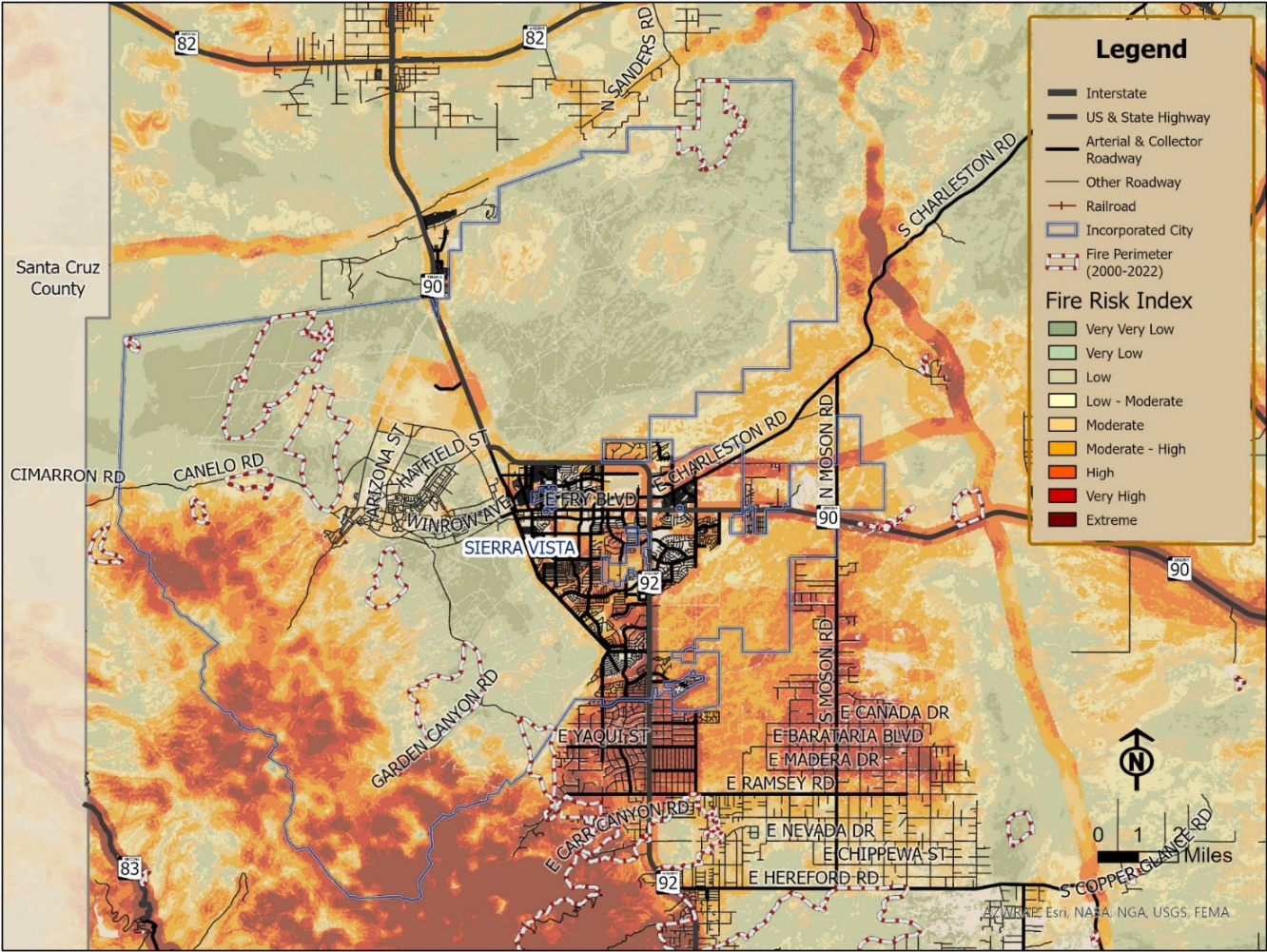




Figure 5.47. City of Tombstone Wildfire Risks

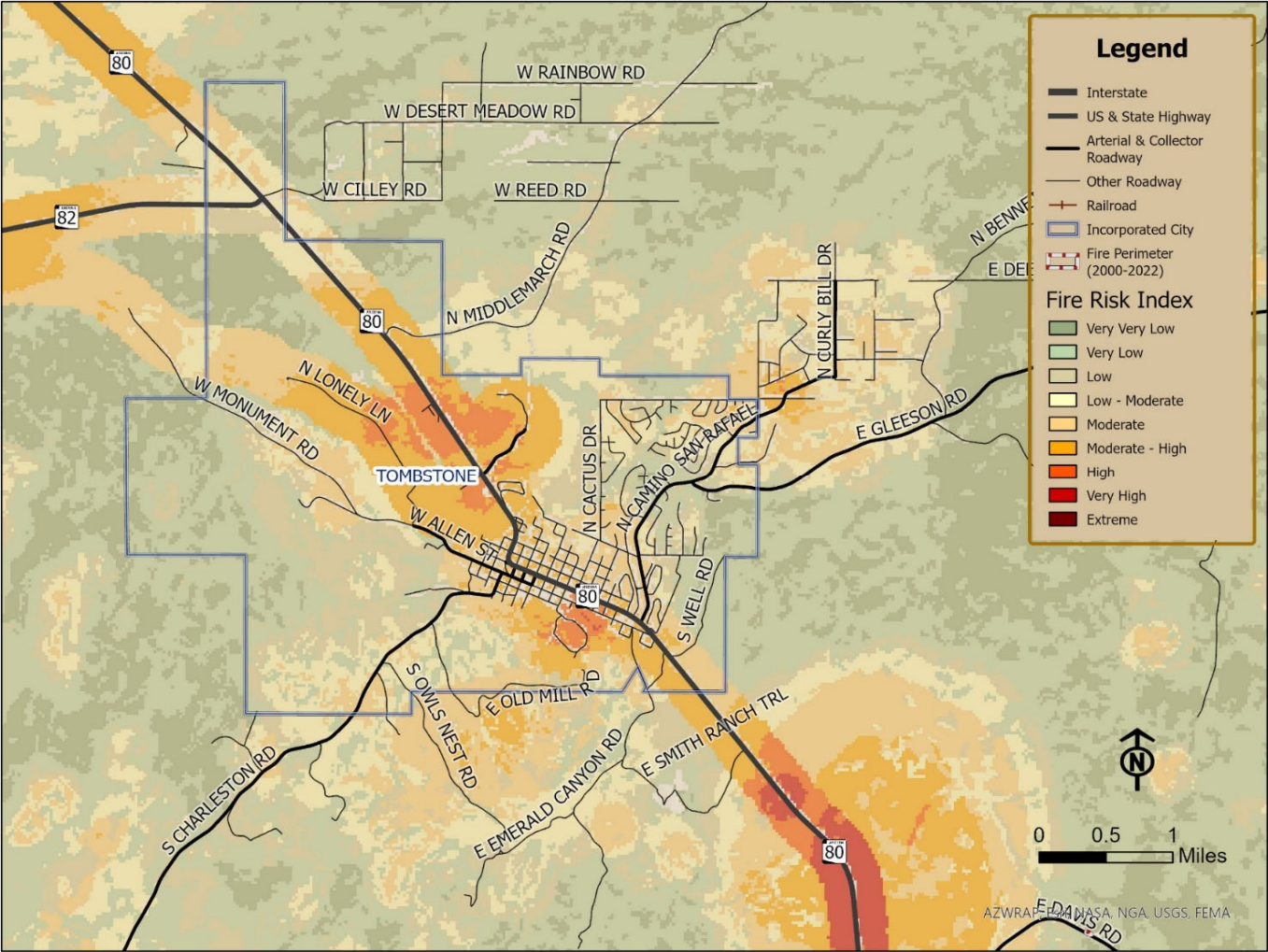
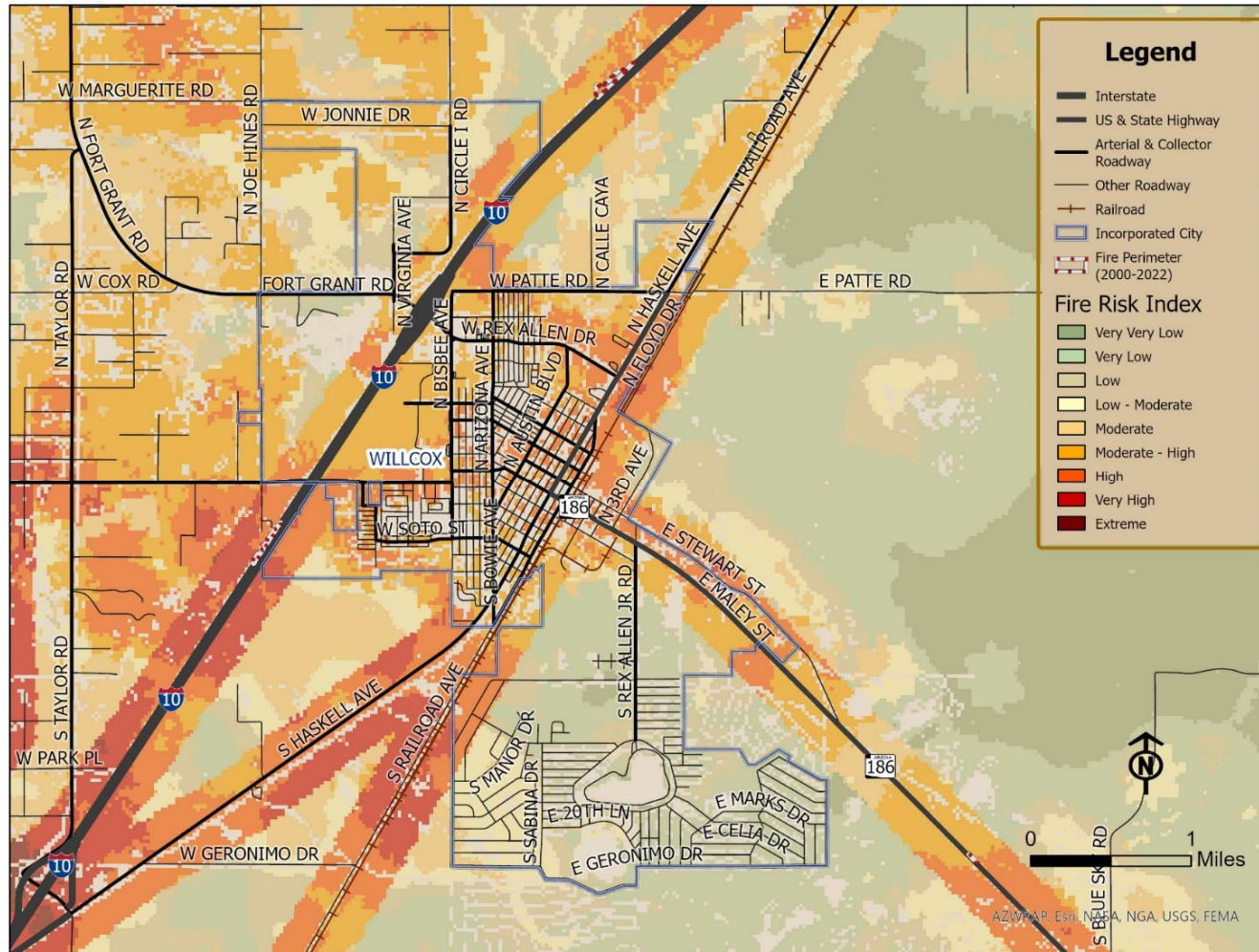


Figure 5.48. City of Willcox Wildfire Risks



## SECTION 6: MITIGATION STRATEGY

The mitigation strategy provides a collection of mitigation actions and projects that reduce or possibly remove the community's exposure to hazard risks. According to DMA 2000, the primary components of the mitigation strategy are generally categorized into the following:

- Goals and Objectives
- Capability Assessment
- Mitigation Actions/Projects, and
- Implementation Strategy

The Planning Team reviewed and updated the 2017 Plan mitigation strategy. Specifics of the changes and updates are discussed in the subsections below.

### 6.1 Hazard Mitigation Strategy

An assessment of the 2017 Plan goals and objectives by the Planning Team was made with consideration of the following:

- Do the goals and objectives identified in the 2017 Plan reflect the updated risk assessment?
- Did the goals and objectives identified in the 2017 Plan lead to mitigation projects or changes to the policy that helped the jurisdiction(s) to reduce vulnerability?
- Do the goals and objectives identified in the 2017 Plan support any changes in mitigation priorities?
- Are the goals and objectives identified in the 2017 Plan reflective of current State goals?
- Do the goals and objectives still align with the updated 2018 State Plan?

After discussion, the Planning Team slightly edited the goals and objectives from the 2017 version. The main edit was that Objective 3 and Objective 4 from the 2017 Plan were consolidated for clarity. Community resilience was discussed and added as appropriate. The team also felt that mitigation warrants promoting to reduce the burden on first responders and recovery efforts.

Elements of this Mitigation Strategy are:

Goal: Reduce or eliminate the risk to people and property for all hazards.

- Objective 1: Reduce or eliminate the long-term risks from natural disasters to life and property in the incorporated and unincorporated jurisdictions within Cochise County.
- Objective 2: Reduce risk to critical facilities and infrastructure and increase community resilience from all hazards.
- Objective 3: Promote hazard mitigation throughout the incorporated and unincorporated jurisdictions within Cochise County by increasing public, private and governmental awareness of hazards and risks and mitigation opportunities.
- Objective 4: Promote and implement mitigation efforts and strategies to reduce the burden on first responders and recovery efforts during and after disasters.

### 6.2 Capability Assessment

An essential component of the Mitigation Strategy is a review of each participating jurisdiction's resources to identify, evaluate, and enhance the capacity of local resources to mitigate the effects



of hazards. The capability assessment is comprised of several components:

- ✓ Legal and Regulatory Review – a review of the legal and regulatory capabilities, including ordinances, codes, plans, manuals, guidelines, and technical reports that address hazard mitigation activities.
- ✓ Technical Staff and Personnel – this assessment evaluates and describes the administrative and technical capacity of the jurisdiction's staff and personnel resources.
- ✓ Fiscal Capability – this element summarizes each jurisdiction's fiscal capability to provide the financial resources to implement the mitigation strategy.
- ✓ National Flood Insurance Program (NFIP) Participation – the NFIP contains specific regulatory measures that enable government officials to determine where and how growth occurs relative to flood hazards. Participation in the NFIP is voluntary for local governments, but FEMA promotes the program as a fundamental first step for implementing and sustaining an effective flood hazard mitigation program and is a crucial indicator for measuring local capability as part of this assessment.
- ✓ Prior Mitigation Actions – the final part of the capability assessment is a summary review of previous mitigation actions or projects completed over the last five years.

The Planning Team reviewed the information provided in the 2017 Plan and added additional information per the FEMA Local Mitigation Planning Policy Guide FP 206-21-0002.

#### *6.2.1 Jurisdictional Capabilities*

The following Tables summarize each participating jurisdiction's legal and regulatory mitigation capability. Four separate tables have been developed for each jurisdiction. The prior Plan only had three of the four tables.

- The first table covers relevant codes Programs, Policies, and Plans;
- The second table for each jurisdiction covers Codes and Regulations for each jurisdiction;
- The third table for each jurisdiction covers the Financial Resources employed by each jurisdiction to support mitigation efforts; and
- The fourth and final tables summarize each jurisdiction's Staff/Personnel Resources available for mitigation efforts.

In addition to local capabilities, other potential mitigation resources are available to the County and its jurisdictions. These could include but are not limited to Coronado National Forest, Arizona State Parks, Arizona Department of Transportation, U.S. Customs and Border Protection, Fort Huachuca Army Base, Fry Fire Department, Palominas Fire Department, and other state, federal, and local organizations, and unincorporated communities within Cochise County.

**Cochise County Unincorporated Areas**

Table 6.1. Programs, Policies, and Plans for Unincorporated Cochise County		
Erosion Hazard Setback Limits	Purpose	To establish a safe, buildable distance from washes and watercourses for landowners
	Responsible Agency	Engineering and Natural Resources Department Staff
	Hazards	Erosion, Flood
	Effect on Mitigation Efforts	Allows landowners to build safely to enjoy their property.
	Opportunities for Enhancement	The department also analyzes regulatory floodplains that may not be FEMA-governed.
Open Space	Purpose	To promote projects that allow Floodplain open space adjacent to regulatory watercourses (500cfs min). The riparian habitat provides such natural controls on flooding and erosion by helping maintain water quality by filtering nutrients and refreshing aquifers, and reducing the frequency and duration of low surface flows.
	Responsible Agency	Engineering and Natural Resources
	Hazards	Flood, erosion control, drought
	Effect on Mitigation Efforts	It enhances biological productivity by supporting a high rate of plant growth and maintaining the biodiversity necessary to keep the integrity of the ecosystems.
	Opportunities for Enhancement	These riparian habitats provide excellent environments for fish and wildlife

Table 6.2. Codes & Regulations for Unincorporated Cochise County		
Cochise County Floodplain Regulations	Purpose	Establish federal and state laws within Cochise County to provide and promote the public health, safety, and general welfare of its citizenry.
	Responsible Agency	Cochise County Flood Control District
	Hazards	Flood, drought, fissures, wind
	Effect on Mitigation Efforts	Allows citizens to participate and maintain eligibility for flood insurance and disaster relief
	Opportunities for Enhancement	To update and define more accurate interpretations of the ordinance as the development of the County expands
Cochise County Zoning Regulations	Purpose	To conserve and promote public health, safety, convenience, and general welfare and to provide for the future growth and improvement of the unincorporated area of Cochise County following the Cochise County Comprehensive Plan.
	Responsible Agency	Development Services Department

	Hazards	Floods, fissures, fires, natural disasters,
	Effect on Mitigation Efforts	The mitigation efforts produce coordinated, adjusted, and harmonious development of land in the entire unincorporated area of Cochise County.
	Opportunities for Enhancement	To customize the character and stability of each County district, based on setback distances made by providing adequate light, air, and parking facilities; promoting adequate traffic circulation; and preventing overcrowding of land use by provisions zoning requirements reducing the probability of damage from a flood, fire, etc.
Cochise County Subdivision Regulations	Purpose	To promote orderly growth by providing adequate roads, utilities, water, and wastewater treatment, ensuring that structures are not built-in areas subject to flooding, and ensuring an accurate legal description when dividing a large parcel into smaller lots for sale.
	Responsible Agency	Development Services Department
	Hazards	Flood, fire, land subsidence, wind
	Effect on Mitigation Efforts	Establish procedures and standards for all subdivisions that are compliant and consistent that provide for the orderly growth and harmonious development of the County.
	Opportunities for Enhancement	To ensure that future residents of these subdivisions are given a safe, healthy, and positive general welfare of being in a regulated subdivision.
Cochise County Hazardous Materials, Response & Recovery Plan, 1991; revised February 2015.	Purpose	To provide local hazard analysis by developing a hazmat response capability, exercising the plan, incorporating emergency planning, and training local responders.
	Responsible Agency	Cochise County Emergency Management Department
	Hazards	Floods, fire, hazardous materials, fissures, storms, etc.
	Effect on Mitigation Efforts	The Local Emergency Planning Committee (LEPC) forms partnerships with local governments, communities, academia, and industries as a resource for enhancing hazardous materials preparedness.
	Opportunities for Enhancement	To allow local governments to be responsible for integrating a HAZMAT planning and response team within their jurisdiction.

Table 6.3. Financial Resources for Unincorporated Cochise County		
River Gage Funding	Purpose	Maintain funding for River gage maintenance (Babacomari River, San Pedro River)
	Responsible Agency	Cochise County Board of Supervisors; Cochise County Flood Control District; ADWR
	Hazards	Flood
	Effect on Mitigation Efforts	Joint effort to combine funds to continue gage maintenance

FCD Funds	Purpose	To install two more ALERT gages countywide; sites to be determined
	Responsible Agency	Engineering and Natural Resources Department
	Hazards	Flood
	Effect on Mitigation Efforts	Continue the program of installing rain gages in areas that have minimal resources

Table 6.4. Staff/Personnel/Department/Agency Resources for Unincorporated Cochise County	
Staff/Personnel Resources	Involvement
Community Volunteers	Annual San Pedro River Walk during the summer to mark where natural springs are located to monitor drought conditions.
Engineering and Natural Resources Department Staff; Emergency Management Services Department Staff; Development Services Staff;	Community outreach at the County Fair, community meetings, and all social media platforms to inform the public of resources available for conditions pertaining to floods, drought, fissures, natural hazards and how to help take care of themselves to prepare for natural hazards, wildfires, and flooding

#### **Benson Capabilities**

Table 6.5. Programs, Policies, and Plans for Benson		
General Development Plan	Purpose	State-mandated document covering growth and development in Benson. Adopted every 10 years, reviewed every year, updated 2011 – map cha
	Responsible Agency	Development Services
	Hazards	Fire, Flood, and others
	Effect on Mitigation Efforts	Medium. Much of Benson is currently undeveloped
	Opportunities for Enhancement	Reviewed every year
Airport Master Plan 2007	Purpose	To guide improvements made at the Benson Airport
	Responsible Agency	Public Works
	Hazards	Fire, Flood, and others
	Effect on Mitigation Efforts	low
	Opportunities for Enhancement	The Airport is used to fight wildfires during the fire season

Table 6.6. Codes & Regulations for Benson		
International Building Code 2015	Purpose	To have safe new construction.
	Responsible Agency	Development Services
	Hazards	Building Failures

	Effect on Mitigation Efforts	Medium. Benson has many older structures
	Opportunities for Enhancement	Update Code from 2015 to 2018 or 2021
International Fire Code 2015	Purpose	To help prevent or mitigate Fire hazards
	Responsible Agency	Development Services/Fire Department
	Hazards	Fire
	Effect on Mitigation Efforts	Medium. Benson has many older structures
	Opportunities for Enhancement	Update Code from 2015 to 2018 or 2021
Floodplain Management Ordinance 305&355	Purpose	To promote and protect the health, peace, safety, comfort, convenience, and general welfare of the residents within the jurisdictional area of Benson, Arizona; to minimize public and private losses due to flooding; and to enable its residents to participate in the National Flood Insurance Program (NFIP), receive federal disaster assistance, obtain flood insurance, and reduce the cost of flood insurance.
	Responsible Agency	Cochise County Flood Control District/Development Services
	Hazards	Flood
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	None Identified

Table 6.7. Financial Resources for Benson		
Capital Improvements Project funding	Purpose	Budget for all projects for more than \$10,000 and 3-year life
	Responsible Agency	City Wide
	Hazards	Any Hazards
	Effect on Mitigation Efforts	Depends on project
Community Development Block Grants	Purpose	Grant funds for capital projects to benefit low to moderate-income people
	Responsible Agency	SEAGO/City of Benson
	Hazards	Any Hazards or other benefit
	Effect on Mitigation Efforts	Depends of project
Fees for water, sewer, gas, or electric service	Purpose	Funding for each utility
	Responsible Agency	Public Works
	Hazards	Any for that utility
	Effect on Mitigation Efforts	High water for fire hazard
Bonding	Purpose	Financing large projects
	Responsible Agency	Public Works/Finance
	Hazards	Any
	Effect on Mitigation Efforts	Depends on project

Table 6.8. Staff/Personnel/Department/Agency Resources for Benson	
Staff/Personnel Resources	Involvement
Fire Chief	Emergency Manager and grant writing
City Engineer	Design and construction of projects to mitigate hazards
Development Services	GIS and building code enforcement. Including building inspection. Includes P&Z commission
Floodplain Manager	Cochise County Flood Control District. Enforcement of Floodplain codes

### **Bisbee Capabilities**

Table 6.9. Programs, Policies, and Plans for Bisbee		
Cochise County Community Wildfire Preparedness Plan	Purpose	Identify and categorize community risk to wildfires occurring across Cochise County.
	Responsible Agency	Cochise County
	Hazards	Wildland and Urban Interface fires.
	Effect on Mitigation Efforts	This plan provides a comprehensive outlook and landscape scale prioritization of efforts to support wildfire prevention, response, and recovery.
	Opportunities for Enhancement	The current plan was developed in 2014 and is due for an update. An update is scheduled for 2023.
Cochise County Road Construction Standards and Specifications	Purpose	Standardizes engineering design guidelines for roadway design elements in Cochise Co.
	Responsible Agency	Public works
	Hazards	Flood
	Effect on Mitigation Efforts	Following road construction standards and specs to ensure that road work always mitigates and avoids the possibility of flooding problems.
	Opportunities for Enhancement	Meet with the County to discuss flooding potential where it pertains to roads for a deeper understanding of the risks.
USPP-2005 Water Management and Conservation Plan, the Governor's Drought	Purpose	Provides information on the Upper San Pedro Partnership's water management and conservation efforts since the release of last year's Plan (March 2005).
	Responsible Agency	City of Bisbee and Cochise County

Mitigation Task Force, and the drought preparedness plan.	Hazards	Drought
	Effect on Mitigation Efforts	Supports all-hazard risk reduction, open and working land resilience, and environmental protection and restoration.
	Opportunities for Enhancement	Continued and ongoing collaboration and grant writing to fund the project.
Bisbee General Plan- 2015	Purpose	Provide a unified vision of the Town's growth and development in accordance with the wishes of the Town's residents, property owners, and stakeholders. This planning document serves as a guide for the City council, City Planning Dept., City Staff and the general public regarding future development, growth, and land use activity. It outlines the community's goals and objectives, establishes the land use and circulation plans, and provides recommendations, policies, and implementation strategies to meet them.
	Responsible Agency	Code Official and varied City departments.
	Hazards	All
	Effect on Mitigation Efforts	It lessens vulnerability to identified hazards
	Opportunities for Enhancement	The plan is updated every ten years to allow the public to express their views on the town's future and for adjustments to be made due to changing environment/circumstances of the town. Slated to be updated in 2025
EPA and City of Bisbee- Preparing for Extreme Weather Events Adaptation Plan (2012)	Purpose	Outlines steps to guide the City on how to best adapt to extreme weather events
	Responsible Agency	All City Departments but primarily Police/Fire/Public Works
	Hazards	All
	Effect on Mitigation Efforts	Would impact mitigation and response to hazards which can lessen the impact on life/property
	Opportunities for Enhancement	Find funding to implement the plans.
Bisbee Civic Town Plan: Planning the Past, Saving the Future (Charrette) SHPO and The City of Bisbee Sustainability Plan- 2017-2018	Purpose	The collaborative policy guides historic preservation actions in concert with comprehensive objectives in the City of Bisbee.
	Responsible Agency	City planners, Code Official
	Hazards	All
	Effect on Mitigation Efforts	Effective planning maintains historic resources and can prevent hazards from happening or lessen their impact on life and property.
	Opportunities for Enhancement	Implement plans, public education, and enforcement



Cochise County HMP	Purpose	FEMA approved County Wide Hazard Mitigation Plan utilizing feedback from stakeholders.
	Responsible Agency	City of Bisbee- all departments
	Hazards	All
	Effect on Mitigation Efforts	Defines all mitigation plans.
	Opportunities for Enhancement	Participating in developing new/updated plans. Working to implement plans.

Table 6.10. Codes & Regulations for Bisbee		
2012 International Building Code	Purpose	Adopted building code for construction within the City
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	Update Code as required
2012 International Residential Code (this does not include Bisbee's amendments to the IRC)	Purpose	Adopted building code for residential construction within the Town
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	This code was updated with IRC amendments
2012 International Fire Code	Purpose	Adopted fire code for construction within the Town
	Responsible Agency	Code Official and Fire Chief
	Hazards	Fires
	Effect on Mitigation Efforts	High
	Opportunities for Enhancement	Update Code as required
2012 International Mechanical Code	Purpose	Adopted mechanical code for construction within the Town
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	Update Code as required
2012 International Plumbing Code	Purpose	Adopted plumbing code for construction within the Town
	Responsible Agency	Code Official
	Hazards	All

	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	Update Code as required
2012 International Energy Conservation Code	Purpose	Adopted energy conservation code for construction within the Town
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	Update Code as required
2012 International Existing Building Code	Purpose	Adopted building code for existing buildings within the Town
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	Update Code as required
2014 National Electric Code	Purpose	Adopted electrical code for construction within the Town
	Responsible Agency	Code Official
	Hazards	All- especially fire
	Effect on Mitigation Efforts	Medium-High
	Opportunities for Enhancement	Update Code as required
2012 International Property Maintenance Code	Purpose	Adopted code for appropriate property maintenance within the City
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	Enforcement
Floodplain Management Ordinance	Purpose	To promote and protect the health, peace, safety, comfort, convenience, and general welfare of the residents within the jurisdictional area of Bisbee to minimize public and private losses due to flooding; and to enable its residents to participate in the National Flood Insurance Program (NFIP), receive federal disaster assistance, obtain flood insurance, and reduce the cost of flood insurance.
	Responsible Agency	The City has IGA with Cochise County for Floodplain Management Services. The Code Official is the point of contact for the Town. Cochise County Highway & Floodplain and Board of Supervisors
	Hazards	Flooding
	Effect on Mitigation Efforts	High
	Opportunities for Enhancement	Establish better communication with the public regarding the requirements of development within the floodplain areas of the Town.

Table 6.11. Financial Resources for Bisbee		
Community Development Block Grants	Purpose	Water/Sewer Infrastructure Improvement and Abatement of Abandoned Structures
	Responsible Agency	SEAGO/Town Council
	Hazards	Flooding/Wildfire/Building collapse
	Effect on Mitigation Efforts	Funding may be available for the abatement of structures or for improvements to our water/sewer infrastructure to improve their resistance to threats identified above
Arizona Department of Forestry and Fire Management Grants	Purpose	Hazardous wildfire fuel reduction and healthy forest development
	Responsible Agency	Arizona Department of Forestry and Fire Management
	Hazards	Wildland and Urban Interface Fires
	Effect on Mitigation Efforts	Grant funding may be available for hazard assessment, fuel reduction, fire break development, and public education.
US Forest Service Grants	Purpose	Community Wildfire Protection Plan development and wildfire hazard mitigation
	Responsible Agency	US Forest Service
	Hazards	Wildland and Urban Interface Fires
	Effect on Mitigation Efforts	Support coordinated planning and wildfire hazard mitigation, prevention, and education
Capital Improvement Fund revenues, 1% sales tax	Purpose	Water/Sewer Infrastructure and Equipment to facilitate improvements
	Responsible Agency	Public Works
	Hazards	Wildfire/Flooding
	Effect on Mitigation Efforts	It can be used to make improvements to build a more robust defense against identified hazards
General Fund appropriations	Purpose	Funding for hazard mitigation activities, such as matching money required for many grants.
	Responsible Agency	City of Bisbee
	Hazards	All
	Effect on Mitigation Efforts	Increases opportunities for grant funding opportunities for hazard mitigation.
Other Grants and Intergovernmental Funds; FEMA grants- BRIC HMGP, WIFA grants and loans, USDA RD, EDA, NAD Bank grants and loans, RICO and Federal	Purpose	Hazard mitigation activities can be extremely expensive- beyond the financial capabilities of the City budget. Grant monies from various agencies are necessary to meet the Hazard mitigation planning and implementation projects.
	Responsible Agency	City of Bisbee
	Hazards	All Hazards
	Effect on Mitigation Efforts	With appropriate funding, mitigation efforts can be planned for and implemented.

Asset Forfeiture funds, ADOT grants.		
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Table 6.12. Staff/Personnel/Department/Agency Resources for Bisbee	
Staff/Personnel Resources	Involvement
City of Bisbee Fire Department	Contract emergency services provider responsible for conducting fire inspections, pre-fire incident planning, and all fire and emergency medical service incident management and resolution.
Zoning Officer/Code Official	Code official is responsible for enforcement of the adopted building codes; enforcement of the zoning codes; enforcement of the City code regarding property and building maintenance; point of contact for the City for floodplain issues (City has IGA with Cochise County for Floodplain Management Services)
Public Works/Public Works Manager and Operation Manager in Public works	Helps identify potential hazards and impacts on residents and our infrastructure and develop proper mitigation plans/actions. Responsible for water and sewer operations as well as public infrastructure.
Police Department	Helps identify potential hazards for residents and possible courses of action to lessen them. Responsible for public safety and emergency operations.
City Manager	Oversees and manages City Operations, including developing hazard mitigation plans and interfaces with staff and council to execute and implement the mitigation measures.
Grant Writers	Pursue potential grant, donation, and loan opportunities to implement Hazard Planning, Mitigation, and Response and Recovery activities.
Cochise County Staff /engineers/	Maintains all plans and maps required for Hazard mitigation pertaining to local governments and communities.
City of Bisbee Staff	Education projects
Public Manager/ Code Official	Works in conjunction with the County for Flood plain management.
On Call Engineers	Available for specific contracted engineering work and consultation for future projects.
Operations Manager	GIS mapping
Fire Chief for Emergency management	Manages local Emergencies and is the County Liaison.

### **Douglas Capabilities**

Table 6.13. Programs, Policies, and Plans for Douglas		
Douglas General Plan April, 2002 (Updated General Plan expected June of 2023)	Purpose	
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	
Douglas Municipal Airport Master Plan Update: Plan specifying design standards and airport safety measures. (Updated December 2017)	Purpose	
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	
Water Master Plan: (Aug 1996) (Risk & Resilience Assessment Summary completed August 2020)	Purpose	The Water Supply Master Plan outlines the City's options and strategies for meeting future water demands and provides stages and phasing for capital improvements related to the water supply system's infrastructure needs.
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	
Drainage Master Plan: Drainage master plan and CIP. (Sept 2002)	Purpose	
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	
Emergency	Purpose	

Operations Plan (Updated February 2019)	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	
Douglas Strategic Plan 2022-2023	Purpose	Establishes the Vision for the Future, Policy Priorities of Infrastructure/Downtown Revitalization/Managing Growth & Annexations/Economy, Jobs & Amenities/Community Facilities, Special Events & Tourism/Streets & Roads
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
Cochise Co Road Construction Standards and Specifications: Standardizes engineering design guidelines for roadway design elements in Cochise Co.(Apr 2005)	Opportunities for Enhancement	
	Purpose	
	Responsible Agency	Dept of Public Works, Planning & Zoning And Engineering Divisions
	Hazards	
2018 Douglas-Agua Prieta Flood Mitigation Alternative Evaluation Study	Effect on Mitigation Efforts	
	Opportunities for Enhancement	
	Purpose	
	Responsible Agency	
Drainage Report: Drainage improvements. (1976) Updated Flood	Hazards	
	Effect on Mitigation Efforts	
	Purpose	
	Responsible Agency	

Water Drainage Assessment is underway.	Opportunities for Enhancement	
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**Table 6.14. Codes & Regulations for Douglas**

Uniform Building Code, 1997 Edition	Purpose	
	Responsible Agency	Dept of Public Works, Building Safety Division
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	
Special Purpose Ordinance: Flood Hazard Control - Chapter 15.20 of the City Code	Purpose	
	Responsible Agency	Dept of Public Works, Engineering Division
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	

**Table 6.15. Financial Resources for Douglas**

Community Development Block Grants	Purpose	
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
Capital Improvements Project funding	Purpose	
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
Incur debt through general obligation bonds	Purpose	
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
	Purpose	



Community Development Block Grants	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
Authority to levee taxes for specific purposes Incur debt through general obligation bonds	Purpose	
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
Fees for water, sewer, gas, or electric service	Purpose	
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	

Table 6.16. Staff/Personnel/Department/Agency Resources for Douglas	
Staff/Personnel Resources	Involvement
Public Works Director / City Engineer (hired 10/10/2022, previously contracted)	Planner(s) or engineer(s) with knowledge of land development and land management practices. Engineer(s) or professional(s) trained in construction practices related to buildings or infrastructure. Floodplain manager. Education and expertise for addressing mitigation needs for the City.
City Planner	
Consultant Contract Scientists	Utilized for mitigation and other projects and familiar with hazards.
Fire Dept, Fire Chief; Police Dept – Police Chief	Emergency management for the City. Familiar with preparedness, mitigation, response, and recovery activities for the City.
Grants Coordinator/Project Manager	Active in mitigation grant access and familiar with City's hazards.
Neighborhoods Housing/Grants-Director	Assist with grant writing and coordination.

### **Huachuca City Capabilities**

Table 6.17. Programs, Policies, and Plans for Huachuca City		
Cochise County Community Wildfire Preparedness Plan	Purpose	Identify and categorize community risk to wildfires occurring across Cochise County.
	Responsible Agency	Cochise County
	Hazards	Wildland and Urban Interface fires.
	Effect on Mitigation Efforts	This plan provides a comprehensive outlook and landscape scale prioritization of efforts to support wildfire prevention, response, and recovery.
	Opportunities for Enhancement	The current plan was developed in 2014 and is due for an update.
Huachuca City Pre-Incident Fire Plans	Purpose	Pre-incident hazard assessment for commercial occupancies that may be involved in structure fires.
	Responsible Agency	Fry Fire District
	Hazards	Structure fires.
	Effect on Mitigation Efforts	These plans provide fire suppression personnel with fire and life-safety-related information before an emergency incident.
	Opportunities for Enhancement	Pre-Incident Fire Plans are updated annually by fire personnel, often in conjunction with regular business inspections.
Ft. Huachuca Sentinel Landscape Strategic Plan	Purpose	Protect and enhance national defense by supporting the mission of Ft. Huachuca
	Responsible Agency	US Dept. of Defense
	Hazards	Any threats to continuing operations on Ft. Huachuca
	Effect on Mitigation Efforts	Supports all-hazard risk reduction, open and working land resilience, and environmental protection and restoration.
	Opportunities for Enhancement	Continued and ongoing collaboration.

Huachuca City General Plan (2016)	Purpose	The primary objective of the Town of Huachuca City General Development Plan is to provide a unified vision of the Town's growth and development in accordance with the wishes of the Town's residents, property owners, and stakeholders. This planning document guides the Town Council, Town Planning Dept., Town Staff, and the general public regarding future development, growth, and land use activity. It outlines the community's goals and objectives, establishes the land use and circulation plans, and provides recommendations, policies, and implementation strategies to meet them.
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium since the plan is already in place. It lessens vulnerability to identified hazards
	Opportunities for Enhancement	The plan is updated every ten years to allow the public to express their views on the Town's future and for adjustments to be made due to changing environment/circumstances of the town. Slated to be updated in 2026
Emergency Response Plan (2007)	Purpose	Outlines steps to guide the community in the event of an emergency
	Responsible Agency	All Town Departments but primarily Police/Fire/Public Works
	Hazards	All
	Effect on Mitigation Efforts	Would impact response to hazards which can lessen the impact on life/property
	Opportunities for Enhancement	Needs review/update to incorporate ADEQ-approved emergency plans for water/sewer. Also needs an annual review.

Table 6.18. Codes & Regulations for Huachuca City		
2018 International Building Code	Purpose	Adopted building code for construction within the Town
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	This code was very recently updated
2018	Purpose	Adopted building code for residential construction within the Town

International Residential Code	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	This code was very recently updated
2018 International Fire Code	Purpose	Adopted fire code for construction within the Town
	Responsible Agency	Code Official and Fire Chief
	Hazards	Wildfire
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	This code was very recently updated
2018 International Mechanical Code	Purpose	Adopted mechanical code for construction within the Town
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	This code was very recently updated
2018 International Plumbing Code	Purpose	Adopted plumbing code for construction within the Town
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	This code was very recently updated
2018 International Energy Conservation Code	Purpose	Adopted energy conservation code for construction within the Town
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	This code was very recently updated
2018 International Existing Building Code	Purpose	Adopted building code for existing buildings within the Town
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	This code was very recently updated
2020 National Electric Code	Purpose	Adopted electrical code for construction within the Town
	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	This code was very recently updated
1997 Uniform	Purpose	Adopted code for the abatement of dangerous buildings within the Town

Code for the Abatement of Dangerous Buildings	Responsible Agency	Code Official
	Hazards	All
	Effect on Mitigation Efforts	Medium
	Opportunities for Enhancement	This is an older code, but still very effective
Floodplain Management Ordinance	Purpose	To promote and protect the health, peace, safety, comfort, convenience, and general welfare of the residents within the jurisdictional area of Huachuca City to minimize public and private losses due to flooding; and to enable its residents to participate in the National Flood Insurance Program (NFIP), receive federal disaster assistance, obtain flood insurance, and reduce the cost of flood insurance.
	Responsible Agency	The town has IGA with Cochise County for Floodplain Management Services. The Code Official is the point of contact for the Town.
	Hazards	Flooding
	Effect on Mitigation Efforts	High
	Opportunities for Enhancement	Establish better communication with the public regarding the requirements of development within the floodplain areas of the Town.

Table 6.19. Financial Resources for Huachuca City		
Community Development Block Grants	Purpose	Water/Sewer Infrastructure Improvement and Abatement of Abandoned Structures
	Responsible Agency	SEAGO/Town Council
	Hazards	Flooding/Wildfire/Building collapse
	Effect on Mitigation Efforts	Funding may be available for the abatement of structures or for improvements to our water/sewer infrastructure to improve their resistance to threats identified above
Arizona Department of Forestry and Fire Management Grants	Purpose	Hazardous wildfire fuel reduction and healthy forest development
	Responsible Agency	Arizona Department of Forestry and Fire Management
	Hazards	Wildland and Urban Interface Fires
	Effect on Mitigation Efforts	Grant funding may be available for hazard assessment, fuel abatement, fire break development, and public education.
US Forest Service Grants	Purpose	Community Wildfire Protection Plan development and wildfire hazard mitigation
	Responsible Agency	US Forest Service
	Hazards	Wildland and Urban Interface Fires
	Effect on Mitigation Efforts	Support coordinated planning and wildfire hazard mitigation, prevention, and education
Capital	Purpose	Water/Sewer Infrastructure and Equipment to facilitate improvements

Improvement Projects	Responsible Agency	Water/Sewer
	Hazards	Wildfire/Flooding
	Effect on Mitigation Efforts	It can be used to make improvements to build a more robust defense against identified hazards

Table 6.20. Staff/Personnel/Department/Agency Resources for Huachuca City	
Staff/Personnel Resources	Involvement
Fry Fire District	Contract emergency services provider responsible for conducting fire inspections, pre-fire incident planning, and all fire and emergency medical service incident management and resolution.
Zoning Officer/Code Official	Code official is responsible for enforcement of the adopted building codes; enforcement of the zoning codes; enforcement of the Town code regarding property and building maintenance; point of contact for the Town for floodplain issues (Town has IGA with Cochise County for Floodplain Management Services)
Public Works	Helps identify potential hazards and their impacts on residents and our infrastructure, along with developing proper mitigation plans/actions. Responsible for water and sewer operations as well as public infrastructure.
Police Department	Helps identify potential hazards for residents and possible courses of action to lessen them. Responsible for public safety and emergency operations.
Town Manager	Oversees and manages Town Operations, including the development of hazard mitigation plans and interfaces with staff and council to execute and implement the mitigation measures.

### **Sierra Vista Capabilities**

Table 6.21. Programs, Policies, and Plans for Sierra Vista		
Vista 2030 General Plan	Purpose	A general plan establishes goals and strategies for future growth and management in land use, environment, transportation, public services, etc. It provides a basis for development regulations and project funding.
	Responsible Agency	Department of Community Development
	Hazards	All
	Effect on Mitigation Efforts	Medium. Helps guide development but is more general than codes or standards.
	Opportunities for Enhancement	The general plan is updated every ten years to reflect changing priorities and community vision. A new general planning process will be beginning in 2023.
Emergency Response and	Purpose	Sierra Vista operational plan for all-hazard emergencies
	Responsible Agency	Sierra Vista Fire and Medical Services, Sierra Vista Police Department

Recovery Plan	Hazards	All
	Effect on Mitigation Efforts	Low. Geared towards response following an emergency rather than mitigation efforts.
	Opportunities for Enhancement	The current plan was drafted in 2008 and needs an update.
Airport Master Plan	Purpose	A plan specifying design standards and airport safety measures
	Responsible Agency	Department of Public Works
	Hazards	Outlines needed infrastructure for response to all hazards
	Effect on Mitigation Efforts	Low. The Master Plan outlines the infrastructure needed for airport operations. It supports emergency management efforts rather than mitigation actions.
	Opportunities for Enhancement	The Airport Master Plan is updated every ten years, and efforts are underway for the next update.
Surface Water Plan	Purpose	Outlines the anticipated flow in each major drainage conveyance in the City and recommends infrastructure improvements to manage stormwater and reduce flooding.
	Responsible Agency	Department of Public Works
	Hazards	Flood/Flash Flood
	Effect on Mitigation Efforts	High. Appropriate infrastructure accommodates flow and reduces flooding impacts to adjacent properties.
	Opportunities for Enhancement	The SWP was recently updated and contains new recommendations from the previous plan drafted in the 1980s.
Wastewater Management and Sewage Master Plan	Purpose	Quantifies the anticipated flow in area sewers and recommends capacity modifications.
	Responsible Agency	Department of Public Works
	Hazards	Flood/Flash Flood
	Effect on Mitigation Efforts	Low. Although the City has separate sanitary and stormwater systems, some stormwater infiltrates sewer lines during larger storm events. The Sewage Master Plan helps to ensure sufficient capacity to protect against overflows.
	Opportunities for Enhancement	The existing plan received its last major update in 1999.
208 Water Quality Management Plan with Amendments	Purpose	Defines the sewer service area of the City of Sierra Vista
	Responsible Agency	Department of Public Works
	Hazards	Flood/Flash Flood
	Effect on Mitigation Efforts	Low.
	Opportunities for Enhancement	Future expansions to the 208 area are possible, given the characteristics and potential expansion of the City's treatment plant.
Vista Transit	Purpose	Sets goals, strategies, and priorities for the future use of Transit funding



Long-Range and Short-Range Plans	Responsible Agency	Department of Public Works
	Hazards	All
	Effect on Mitigation Efforts	Low. Transit would be involved in emergency response rather than mitigation.
	Opportunities for Enhancement	The LRTP and SRTP are updated every couple of years.
Wash Maintenance Policy	Purpose	Sets standards for the maintenance of washes within City limits
	Responsible Agency	Department of Public Works
	Hazards	Drought, Flood/Flash Flood
	Effect on Mitigation Efforts	Medium. Reduces fuel loads and removes potential obstructions from waterways.
Sierra Vista Metropolitan Planning Organization Long-Range Transportation Plan	Opportunities for Enhancement	The Wash Maintenance Policy will need to be updated to include new areas as the City grows.
	Purpose	Identify transportation infrastructure priorities over an extended horizon
	Responsible Agency	Sierra Vista Metropolitan Planning Organization
	Hazards	All
	Effect on Mitigation Efforts	Low. The LRTP ensures an adequate transportation system for responding to emergencies.
	Opportunities for Enhancement	The LRTP was updated about a year ago; the next update would be about five years out.

Table 6.22. Codes & Regulations for Sierra Vista		
2015 International Building Code (with the following adds) <ul style="list-style-type: none"> <li>• Basic wind speed – 90 mph (3-second gust)</li> <li>• Seismic Design Category - B</li> <li>• Exposure – C</li> <li>• Live load – 20lb</li> <li>• Rainfall – 3 inches per hour</li> <li>• Ground snow load – 5lbs</li> </ul>	Purpose	Establish standards for safe, efficient, and aesthetic development
	Responsible Agency	Community Development Department, Sierra Vista Fire and Medical Services
	Hazards	All
	Effect on Mitigation Efforts	High
	Opportunities for Enhancement	The City is looking to adopt the 2018 IBC by the end of 2022 The following are included in the current revision: 2015 International Existing Building Code 2015 International Residential Code 2015 International Mechanical Code 2015 International Plumbing Code 2015 International Fuel Gas Code 2015 International Swimming Pool and Spa Code 2012 International Energy Code Chapter 11 of the 2006 International Residential Code

<ul style="list-style-type: none"> <li>• Weathering – Negligible</li> <li>• Frost line depth – 0</li> <li>• Termite – very heavy</li> <li>• Decay – None to slight</li> <li>• Winter design temperature – 18-20 degrees</li> <li>• Flood hazards – (a) May 1984 &amp; (b) June 2001</li> </ul>		1997 Uniform Code for the Abatement of Dangerous Buildings 2014 National Electrical Code 2009 ANSI Standard for Accessible and Usable Buildings and Facilities
City of Sierra Development Code	Purpose	Establish standards for safe, efficient, and aesthetic development that are compatible with the existing community and the natural environment
	Responsible Agency	Community Development Department
	Hazards	All
	Effect on Mitigation Efforts	High
	Opportunities for Enhancement	The Development Code is updated continually as new best practices are identified and the needs of the community change
City of Sierra Vista Code of Ordinances	Purpose	Establish standards for safe, efficient, and aesthetic development that are compatible with the existing community and the natural environment
	Responsible Agency	City Clerk's Office
	Hazards	All
	Effect on Mitigation Efforts	High
	Opportunities for Enhancement	The Code of Ordinances is updated annually to incorporate new standards which have been adopted in the previous year

Table 6.23. Financial Resources for Sierra Vista		
Community Development Block Grants	Purpose	Develop viable urban communities by providing decent housing and a suitable living environment, and expand economic opportunities, principally for low-and moderate-income persons

	Responsible Agency	Community Development Department
	Hazards	All
	Effect on Mitigation Efforts	Provides quality infrastructure to improve resiliency in distressed areas
Capital Improvements Project funding	Purpose	The process which identifies, prioritizes, and funds capital projects to address infrastructure gaps or improve quality of life within the City
	Responsible Agency	Finance Division
	Hazards	All
	Effect on Mitigation Efforts	Provides a dedicated funding source to address large capital needs
Taxes	Purpose	The City has the authority to levy taxes for specific purposes
	Responsible Agency	Mayor and Council
	Hazards	All, potentially
	Effect on Mitigation Efforts	Can address shortfalls in funding or target a specific improvement area. The County, for example, has a flood control district tax.
Fees	Purpose	The City has established fees for sewer and refuse services. These fees are paid by residents who utilize the services and support the associated enterprise fund.
	Responsible Agency	Mayor and Council, Finance Division
	Hazards	All, potentially
	Effect on Mitigation Efforts	Use-specific fees can help pay for improvements when impacts or benefits exist in one user group rather than the community as a whole
Impact Fees	Purpose	Ensure new residents pay their fair share for improvements to existing infrastructure that are necessitated by new development, such as the widening of a roadway where additional traffic is expected
	Responsible Agency	Mayor and Council, Finance Division, Community Development, and Public Works Departments
	Hazards	All, potentially
	Effect on Mitigation Efforts	Provides a means to upgrade infrastructure which has become obsolete or undersized to meet current needs
Incur debt through general obligation or special tax bonds	Purpose	Bonds are useful when the dollar amount of a single project, or a group of projects, exceeds the current budgeting capability of the City. Projects can be paid for over time.
	Responsible Agency	Mayor and City Council, Finance Division
	Hazards	All
	Effect on Mitigation Efforts	Can fund very large projects
Grants	Purpose	Grants can provide federal, state, or private funding to help offset City costs for a particular project or program

	Responsible Agency	Varies
	Hazards	All
	Effect on Mitigation Efforts	Grant opportunities are numerous, and specific opportunities can be identified for just about any project
Highway User Revenue Fund	Purpose	Derived from the state gas tax, HURF provides funding to support roadways and other associated infrastructure
	Responsible Agency	Department of Public Works
	Hazards	Flood/Flash Flood primarily, but All to some degree
	Effect on Mitigation Efforts	Provides a dedicated funding source for roadway improvements, including associated drainage infrastructure. Also promotes a safe and efficient network for emergency response
Federal Transit Administration	Purpose	Provides funding to sustain transit operations
	Responsible Agency	Department of Public Works
	Hazards	All
	Effect on Mitigation Efforts	It can aid in evacuation in the event of an emergency, especially for vulnerable residents who lack alternate means of transportation
Federal Aviation Administration	Purpose	Provides funding to improve airport infrastructure
	Responsible Agency	Department of Public Works
	Hazards	All
	Effect on Mitigation Efforts	The airport is a critical piece of infrastructure for moving people and supplies in the event of an emergency

Table 6.24. Staff/Personnel/Department/Agency Resources for Sierra Vista	
Staff/Personnel Resources	Involvement
Planners	Knowledge of land development and land management practices enforces codes for new developments
Engineers	Trained in design and construction practices related to buildings and other critical infrastructure, evaluates hazards in determining whether critical infrastructure needs to be closed
Firefighters	Operates machinery and equipment for fire suppression efforts
Floodplain Manager	Evaluates floodplain limits on properties, advise residents with floodplain inquiries
Personnel skilled in GIS	Provides mapping assistance in advance of and during an emergency
Emergency Manager	Coordinates emergency response, ensures staff have received appropriate training, maintains emergency response plans
Grant	Writes and administers grants to ensure compliance with required reporting requirements

Writers/Administrators	
Fire Marshall	Evaluates fire hazards in the City, work with other departments and business owners to mitigate risks, perform inspections of fire alerting and mitigation infrastructure
Building Inspectors	Evaluates plans to ensure conformity with codes, perform inspections of building-related infrastructure
Streets Workers	Performs wash maintenance to reduce fuel loads and keep floodways clear, cuts fire lines, and maintains critical infrastructure
Police Officers	Performs evacuations, addresses immediate life safety concerns, prevents access to unsafe areas
Planning and Zoning Commission	Evaluates new developments for approval based on staff recommendations. Recommends variances, evaluates community planning and zoning concerns, evaluates staff recommendations for code changes

### **Tombstone Capabilities**

Table 6.25. Programs, Policies, and Plans for Tombstone		
Chapter #18 Purchasing Policy	Purpose	The purpose is to authorize the mayor to approve the purchasing agent secure services without complying with procedures outlined in the Policy. A full report, in writing, of the circumstances of any emergency purchase shall be filed by the purchasing agent with the mayor & common council at its next meeting.
	Responsible Agency	City of Tombstone
	Hazards	All Hazards
	Effect on Mitigation Efforts	High, In case of an emergency requiring immediate purchases of supplies or services, time is of the essence.
	Opportunities for Enhancement	This will achieve the goal of providing immediate purchases of supplies or services when time is of the essence for Emergencies.
Emergency Water Preservation Plan	Purpose	Water Conservation in Emergencies
	Responsible Agency	City of Tombstone / Public Works Dept.
	Hazards	Wildfire, Flooding, drought
	Effect on Mitigation Efforts	Under extreme emergency conditions, all non-essential uses of water would be curtailed.
	Opportunities for Enhancement	The City of Tombstone will look at an additional water well as an alternative water source.
Emergency Operations Plan	Purpose	Emergency response plan for water supply. Includes the loss of the highest capacity source, loss of supply due to major component failure, damage to power supply equipment or loss of power, contamination of water in the distribution system as a result of backflow, the collapse of the reservoir roof, breaks in transmission or distribution lines, chemical or microbiological contamination of the water supply,

		water conservation in emergencies and a preventive maintenance program.
	Responsible Agency	City of Tombstone / Public Works Dept.
	Hazards	All Hazards
	Effect on Mitigation Efforts	A Preventive Maintenance Program is in place to mitigate emergencies in Tombstone's Public water system. This includes a disinfection and sampling plan and a Backflow Prevention Program. Inspection and operational training of the distribution system occur at least once a year.
	Opportunities for Enhancement	New programs can be added to the existing Preventive Maintenance Program.
City of Tombstone Contingency & Emergency Response Plan	Purpose	Establishes a process to follow in the event of alert level or discharge limit exceedances, accidental discharges or spills, drainage failure, and emergency response is required by the current APP. The Quality Assurance Plan establishes a standard procedure for in-house water sample testing and is required by the current NPDES permit.
	Responsible Agency	City of Tombstone / Public works WWTP
	Hazards	All Hazards
	Effect on Mitigation Efforts	Contain the spill by constructing berms or dikes. Identify & remedy the cause of the spill, remove spilled material & dispose of it properly. Disinfect the area affected by the spill.
	Opportunities for Enhancement	Emergency Response efforts can always be added and updated.

Table 6.26. Codes & Regulations for Tombstone		
Floodplain Management Ordinance	Purpose	It is the purpose of this ordinance to promote public health, safety, & general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed: To protect human life & health, to minimize the expenditure of public money for costly flood control projects, to minimize the need for rescue and relief efforts associated with flooding & generally undertaken at the expense of the general public, to minimize prolonged business interruptions and minimize damage to public facilities and utilities such as water and gas mains, electric, phone and sewer lines, streets, bridges located in special flood hazards.
	Responsible Agency	Cochise County
	Hazards	Flood
	Effect on Mitigation Efforts	In the code are methods and provisions for reducing flood losses.
	Opportunities for Enhancement	Updating the ordinance will provide Tombstone with modern and needed regulatory tools to mitigate the community's exposure to the impacts of future hazard events with the development of those areas.

City Code, Code current through: Ord. 2021-3, passed 5-11-2021	Purpose	
	Responsible Agency	Public Works Building Inspector; Fire Department
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	
2006 National Electrical Code (NFPA 72)	Purpose	
	Responsible Agency	Public Works Building Inspector; Fire Department
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	
International Plumbing Code	Purpose	
	Responsible Agency	Public Works Building Inspector; Fire Department
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	Code current through: Ord. 2021-3, passed 5-11-2022
International Building Code 2006	Purpose	
	Responsible Agency	Public Works Building Inspector; Fire Department
	Hazards	
	Effect on Mitigation Efforts	
	Opportunities for Enhancement	

Table 6.27. Financial Resources for Tombstone		
Financial Resources are mostly from Grants, Tax Base, and Down payments	Purpose	Financial capabilities, including taxing authority and grant eligibilities. Financial resources include Community Development Block Grants, Capital Improvements Project Funding, authority to levy taxes for specific purposes, fees for water and sewer, impact fees for a homebuyer or new developments, and incur debt through general obligation bonds and special tax bonds. All of these mechanisms require political approval.
	Responsible Agency	City of Tombstone – Mayor and Common Council
	Hazards	All
	Effect on Mitigation Efforts	All these mechanisms above require political approval and can be difficult to implement.



CDBG & ADOH EPA Grant to evaluate Building. Marshal Offices / Police Dept. - 315 E Fremont St	Purpose	The renovation and remodeling of the existing Historic City Hall for use by the Tombstone's Marshal's Office. This building was listed on the National Registry of Historic Places in 1972. The current building was constructed circa 1881.
	Responsible Agency	City of Tombstone / Public Works Dept.
	Hazards	All Hazards, including Health, Safety, and General Welfare of the Public
	Effect on Mitigation Efforts	The effect on Mitigation Efforts is that asbestos and black mold were initially removed from this building to make it useful again as a Public Building for the City of Tombstone. Since 2018, the building has been used as the Tombstone Marshal, police crew, and dispatch operations office. The second phase was the demolition and general construction associated with the renovation and remodeling of the existing Historic City Hall for use by the Tombstone's Marshal's Office.
Lease Agreement: Funded by Local sources, State shared revenues, & enterprise activities as part of each operational budget.	Purpose	For 2022, nine new vehicles for the Marshal's Department and four new trucks for the Public Works Department.
	Responsible Agency	City of Tombstone
	Hazards	All Hazards
	Effect on Mitigation Efforts	These effects are responding to wildfires, flooding, and other hazards.
Tombstone Fire Department for an increase in a stipend rate for the Firefighters.	Purpose	We are proposing a change in our stipend structure that will help keep our firefighters in Tombstone and keep our service to our community intact. The Fire department went from volunteer to full-time.
	Responsible Agency	City of Tombstone
	Hazards	All
	Effect on Mitigation Efforts	This will give us better coverage for Emergency Medical Technicians and faster response times to the citizens needing health care. This Duty Shift stipend is intended for retaining three firefighters to be dedicated at the station for a twenty-four shift, making our fire response more efficient.
Purchase of: Rescue #31 for Tombstone Fire Dept.	Purpose	Approved a request for authorization for the Tombstone Fire Department to purchase an Ambulance/Rescue vehicle.
	Responsible Agency	City of Tombstone
	Hazards	All Hazards
	Effect on Mitigation Efforts	Tombstone has medically upgraded our service to the community by purchasing this vehicle. Tombstone has also obtained a new heart monitor defibrillator, some new extrication equipment, and other vehicle extraction equipment.

Table 6.28. Staff/Personnel/Department/Agency Resources for Tombstone	
Staff/Personnel Resources	Involvement
City Planning Commission	The Mayor & City Council and the current Planning & Zoning Commission are responsible for developing the City's zoning ordinance, land use plan, Master Plan, and subdivision regulations. It is designed to include safety factors to address flooding, poor drainage, steep slopes, rock formations, or other features likely to be harmful to public health, safety, convenience, or general welfare.
Building Official	The Building Official is involved in all matters pertaining to any buildings, plumbing, electrical, or any other inspections shall be vested in the office of the clerk; provided that the council may authorize such deputies as needed to perform any inspection work or other functions that may be required by city ordinance. The Building Official role involves wildfire hazards, building collapse, flood and flash flood hazard reduction, and severe wind hazards.
Planning & Zoning Commission	The commission undertakes and carries out comprehensive studies and surveys of the community's physical, social, and economic conditions as necessary to continuously advise the common council on planning and zoning for the growth, development, restoration, and beautification of the city. It considers present conditions, problems, and potential and desirable changes in the community. It recommends to the common council programs, plans, standards, administrative procedures, and means of coordination with the county and other governmental agencies. Mitigation Effort: Protection from natural and artificial hazards. Floodplains are an area the Zoning Commission may regulate by ordinance.
City Clerk – Interim City Clerk	The Floodplain Board authorizes the city clerk of the city of Tombstone to administer the provisions of the floodplain ordinance.
City of Tombstone City Council	The City Council of the City of Tombstone is engaged in enforcing the floodplain ordinance.

### **Willcox Capabilities**

Table 6.29. programs, Policies, and Plans for Willcox		
City Ordinances	Purpose	Provide for the health and safety of the community and address legal and procedural issues
	Responsible Agency	Willcox Common Council
	Hazards	All hazards
	Effect on Mitigation Efforts	The adoption of City Ordinances provides minimum standards for governance, professional practices, building, land use, utility distribution, flood control,

		transportation, public safety, signage, and public actions that have been regulated based on best practices, health safety, and generally accepted norms.
	Opportunities for Enhancement	Ordinances are reviewed and updated periodically or when updated guidance warrants a review. i.e., International Building Code Updates, adopting new statutes, and changes in GAAP requirements.
Emergency Response Plan	Purpose	Provide a framework for preparation for, response to, and recovery from disasters
	Responsible Agency	Office of the City Manager
	Hazards	All Hazards
	Effect on Mitigation Efforts	preparedness elements in the plan raise wide-spread community awareness of hazards and small- to large-scale mitigation strategies.
	Opportunities for Enhancement	Willcox is currently updating the emergency response plans
General Plan 2040	Purpose	To provide for smart growth within the City of Willcox planning area
	Responsible Agency	Willcox Common Council
	Hazards	All Hazards

Table 6.30. Codes & Regulations for Willcox		
Willcox City Code	Purpose	Provide for Public Safety
	Responsible Agency	Willcox Common Council
	Hazards	All Hazards
	Effect on Mitigation Efforts	Since the adoption of the Code, professional practices, building requirements, land use, signage, and public actions have been regulated based on best practices, health safety, and generally accepted standards.
	Opportunities for Enhancement	Codes are reviewed and updated periodically or when updated guidance warrants an update. i.e., International Building Code Updates, adopting new statutes, and changes in accounting requirements.

Table 6.31. Financial Resources for Willcox		
Source/Name	Purpose	
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
Source/Name	Purpose	

	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
Source/Name	Purpose	
	Responsible Agency	
	Hazards	
	Effect on Mitigation Efforts	
Source/Name	Purpose	

Table 6.32. Staff/Personnel/Department/Agency Resources for Willcox	
Staff/Personnel Resources Department/Agency	Involvement
Public Safety Director/Chief of Police	
Public Works Director	

### 6.2.2 Historical Mitigation Activities

The Table in Appendix D provides an updated summary, by jurisdiction, of historical mitigation activities completed over previous planning cycles. This section will continue to serve as a record of mitigation successes for the county and its jurisdictions. As part of each Plan update, completed mitigation activities from the previous are migrated into this Appendix. In addition, if actions are removed, they will be noted in the Appendix.

No jurisdictions have received funding through any FEMA mitigation grant programs since the prior revision in 2017. Before that, the City of Bisbee was the only participating jurisdiction to receive funding for a project through federal hazard mitigation grant money such as Flood Mitigation Assistance (FMA), Hazard Mitigation Grand Program (HMGP), HMGP Post-Fire Assistance, Pre-Disaster Mitigation (PDM), or Building Resilient Infrastructure and Communities (BRIC) between 2012 and 2017.

In 2001, the City of Bisbee received HMGP funds from the 1993 flooding disaster (FEMA-977-DR) to provide floodproofing of a retaining wall along Brewery Gulch Road, storm drain rehabilitation and structural augmentation for the Mule Gulch drainage channel, stormwater management and slope stabilization for the High Road retaining wall, and stormwater management for the Brooks Apartment drainage system. The total project costs for all four areas amounted to \$787,390. Cochise County jurisdictions have also benefitted from PDM funds procured by DEMA to develop 2007, 2012, and 2017 hazard mitigation plans.

## 6.3 Mitigation Actions and Implementation Strategy

Mitigation actions or projects are those activities identified by a jurisdiction that, when implemented, will reduce the community's exposure and risk to the particular hazard or hazards being mitigated against. The implementation strategy addresses the "*how, when, and by whom?*" questions about implementing an identified action.

The process for defining the list of mitigation actions for the Plan was accomplished in three steps. First, an assessment of the prior activities and projects specified in the 2017 Plan was performed by each jurisdiction and the County. Second, a new list of actions for the updated Plan was developed by combining the carry-forward results from the assessment with any new actions. Third, an implementation strategy for the combined list of actions was performed. Details of each step and the process results are summarized in the following sections.

### 6.3.1 Past Plan Mitigation Actions Assessment

Each jurisdiction reviewed and assessed the actions and projects identified in the 2017 Plan. The assessment included evaluating and classifying each of the previously identified actions based on the following criteria:

- Complete
- Ongoing
- In Process
- Deferred
- Canceled / No Longer Applicable

Any actions with a status of Ongoing, In Process, or Deferred were carried forward to become part of the new list in the tables below for the 2022 Plan. Any actions that were either Completed or Canceled have been moved to Appendix D for continued tracking of mitigation successes and projects that jurisdictions may want to revisit.

### 6.3.2 *New Mitigation Actions and Implementation Strategy*

Upon completion of the assessment summarized in Section 6.3.1, each jurisdiction developed new actions in conjunction with the updated mitigation strategy, the vulnerability analysis capability assessments, public and expert input, and the Team's institutional knowledge of hazard mitigation needs in the community. For new mitigation actions, the Team decided to remove the identification number and create separate tables for each jurisdiction.

Team members were asked to focus on the following four areas for their mitigation actions:

1. Local Plans & Regulations – Government authorities, policies, or codes that influence how land and buildings are developed and maintained.
2. Structure & Infrastructure Projects – Modifying existing infrastructure to remove it from a hazard area or construction of new structures to reduce the impacts of hazards. This could apply to public or private structures, critical facilities, and infrastructure. This type of action also involves projects to construct artificial structures to reduce the impact of hazards.
3. Natural Systems Protection – Actions that minimize damage and losses and preserve or restore the functions of natural systems. Examples include:
  - a. Sediment and erosion control
  - b. Stream corridor restoration
  - c. Forest management
  - d. Conservation easements
  - e. Wetland restoration and preservation
4. Education and Awareness Programs – Sustained programs to educate the public and decision-makers about hazard risks and community mitigation programs.

For each new or updated action, the following elements were identified:

- Priority Ranking – determined by the jurisdictional team as "High," "Medium," or "Low" priority unless otherwise specified.
- Mitigation Action Description – a brief description of the action, including a supporting statement that tells the "what" and "why" reason for the action.
- Hazard(s) Mitigated – a list of hazards mitigated by the action.
- Estimated Costs – concept-level cost estimates that may be a dollar amount or estimated as staff time.
- Anticipated Completion Date – estimated completion date if known or as noted, such as "Ongoing."
- Project Lead – the agency, department, office, or position responsible for the implementation of the action
- Potential Funding Source(s) – any potential sources of funding such as grants, budget allotments, staff time, etc.

Mitigation actions will be reviewed annually for overlapping opportunities to benefit the citizens of Cochise County by reducing redundancy and maintaining consistency.

Table 6.33. Current Mitigation Strategy for Cochise County

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)	Notes
High	Support part-time road crew to perform roadside wildfire hazard fuel reduction along county roads.	Wildfire	\$?	Annually	Public Works-Director		Weed and grass control still continues along road sides. A regular part of the routine maintenance performed by the County.
High	Identify and map new flood hazard areas and update existing mapping in accordance with FEMA & NFIP requirements.	Flooding	\$1,000,000	2024	Engineering & Natural Resources (ENR) Director	Federal Emergency Management Agency (FEMA)	Richland Ranchettes completed, N of Benson and multiple watersheds in Sierra Vista area being mapped or remapped. St.David, Bisbee, Next Re-mapping Effective Map Date Aug. 2024
High	Construction of flood control improvements to address flooding that affects development in Hereford area.	Flooding		Completed 2019	ENR - Director		Projects completed in Stump Canyon, Ash Canyon. Stone Ridge completed.
High	Install and maintain additional in stream, weather, and precipitation gauges in watersheds impacting Cochise County, particularly the eastern part of the county. Scope will include website development and remote dial up for public agencies. The public can view real time data	Flooding	\$500,000	Completed 2020	ENR - Director	Flood Control/ADWR	21 Stations Installed. Completed.
High	Install road signage warning motorists of possible fissure activity in elevated fissure risk areas.	Fissure	\$5,000	Annually	ENR - Director		As needed.



Table 6.33. Current Mitigation Strategy for Cochise County

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)	Notes
High	Continue to partner with AZGS to collect and monitor subsidence satellite data for Cochise County for the purpose of identifying potential hazard areas.	Subsidence, Fissure, Flood	\$10,000 per year	Annually	ENR - Director		FCD Board continues to fund annually \$10K for support for satellite coverage.
High	Davis Road -Two drainage crossing improvements proposed MP5 & MP13	Flooding	\$6,100,000	2025	ENR Director -		Attained environmental clearance. In process of acquiring ROW. MP 9.9 completed funding for MP5 & MP13 pending
High	Davis Road - Design concept report. Design evaluation of Davis Road from Hwy 80 to Hwy 191.	Flooding	\$431,300	2023	ENR Director -		Phase II: ROW declared/acquired Final Plans FY 16/17 being acquired
High	Leslie Canyon Ponds - Obtaining responsibility of breached pond. Constructing to meet jurisdictional dam requirements.	Flooding	\$500,000	2023	ENR Director -		Approximate cost includes Drainage Analysis, design, Engineers Estimate and construction cost
High	Fort Grant - 14 mile asphalt reconstruction. Removing, recycling and repaving Fort Grant Road from Cochise County Line to to Virginia Road to alleviate flooding on roadway and fissure damage.	Fissure/Flooding	\$6M	2022	ENR Director -		14 miles need funding`7 miles completed with cold in-place recycling (\$3,891,600)
Medium	Davis Road – Design, ROW acquisition and construction for improving the roadway and mitigating roadway flooding	Flooding	\$72M	ongoing	ENR Director -		Need Funding

Table 6.33. Current Mitigation Strategy for Cochise County

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)	Notes
Medium	Study, design, and construct a flood control facility to mitigate flooding on Rucker Creek for the Elfrida Community	Flooding	\$750,000	2022	ENR - Director		Notable areas of potential areas made Need funding
Medium	Continue drought mitigation measures for Cochise County as directed by the Governor's Drought Preparedness Plan	Drought	\$250,000	Annually	County Administration		As needed
Medium	Review feasibility of installing upgraded road stabilization at select high risk fissure areas to mitigate roadway damages caused by fissures.	Fissure	\$50,000	2022	ENR - Director		Monitoring conditions, will address if needed
Low	Perform construction to mitigate flood damage and maintain access along Moson Road. As a part of the process, project assessment and scoping will be performed to identify and prioritize improvement locations.	Flooding	\$5,000,000	2022	ENR - Director		Project assessment done. Funding needed for ROW & construction Funding needed for drainage easement
Low	Review existing Cochise County building codes for inclusion of provisions for addressing severe winds and revise as needed to protect existing and future structures.	Severe Wind	\$250,000	2022	Planning & Zoning Division-Director		
High	Bella Vista Recharge- Design and build a detention facility for the San Pedro River System	Flooding	\$8,300,000	2022	ENR - Director	NRCS, Readiness and Environmental	Mitigating against flooding by detaining waters near San Pedro. In the design stage.

Table 6.33. Current Mitigation Strategy for Cochise County

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)	Notes
						Protection Integration (REPI) Challenge	Funds for construction may need to be obtained from multiple channels.
High	Continued implementation and tracking of projects identified in May 2014 Cochise County Community Wildfire Protection Plan (CWPP).	Wildfire		Annually	Cochise County Emergency Services	DFFM Grants	Will be updating the CWPP in 2023 with new Wildfire Mitigation Projects
High	Drainage repair: Washington & 34th; Bay Acres	Flooding	\$500,000	2020	ENR - Director		Multiple drainage repair, Design Concept Report, Design documents and projects needed to minimize and/or help alleviate flooding hazards

Table 6.34. Current Mitigation Strategy for Benson						
Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
High	Obtain and place signage and barricades at wash crossings within the city to reduce loss of life and property damage due to vehicular crossing of flooded washes.	Flooding	\$100,000	2026	Public Works	CIP
Medium	Continue to enforce zoning and building codes through current site plan, subdivision, and building permit review processes to reduce the effects of drought, flood, severe wind, and other hazards on new buildings and infrastructure.	All Hazards	\$20,000	2025	Development Services	General Fund
Medium	Expand and maintain the City's Fire Wise programs for all communities, neighborhoods and homeowners' associations within the wildland fire/urban interface including instruction materials, facilitating partnerships with insurance agencies, clean-up crew programs.	Wildfire	\$10,000	2024	Fire/BLM	Grant
Low	Union Street Wash Crossing Improve existing culvert crossing to provide additional capacity to provide improved access to the only access to neighborhood area in times of flooding	Flooding	\$150,000	2026	Public Works	CIP / Grant

Table 6.34. Current Mitigation Strategy for Benson						
Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
Medium	Establish interconnection of Whetstone and Benson water system for reliability	Drought	\$350,000	2026	Public Works	CIP
Medium	Improve drainage System on Northeast side of Benson at river to increase capacity	Flooding	\$500,000	2026	Public Works	Grant

Table 6.35. Current Mitigation Strategy for Bisbee

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
High	Per EPA guidance- abandon the current fire suppression system in Old Bisbee and upgrade Arizona Water Company's potable water system to the support the fire suppressions system bringing it to hydrant, pressure and flow code. Bring hydrants out to the edge of the community (WUI) providing ability to prepare land in anticipation of approaching wildfire.	Wildfire	\$50,000,000	2027	Arizona water/City of Bisbee	FEMA BRIC/ WIFA Grants
High	Commerce Street is a road over the drainage channel that is failing and needs to be supported and rebuilt. 600 feet of roadway is at risk of collapse.	Flood	Preliminary design \$100,000 Construction \$10,000,000	2027 Ongoing maintenance	City of Bisbee with Contracted engineers and construction contractor.	USDA Grant
High	Bisbee retaining walls (5) at risk of failing due to excessive rainfall. Shore	Flood	\$300,000	2027	City of Bisbee with Contracted engineers and construction contractor.	Public works/streets and infrastructure budget. 1% tax increase.

Table 6.35. Current Mitigation Strategy for Bisbee

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
High	Flood water conveyance channel walls repair and reconstruction. 2,500 feet  With failure there is a risk of utility disruption, damage to public and private property.	Flood	\$2,000,000	2027 Maintenance ongoing.	City of Bisbee with Contracted engineers and construction contractor.	Public works/streets and infrastructure budget. 1% tax increase.
High	City of Bisbee will be updating the CWPP in conjunction with Cochise County in 2023. Fuels reduction on City property but not on private property and community education for private property fuels reduction through Firewise education on social media and newspapers, pamphlets and in person yard/home evaluations and education booths at community events.	Wildfire	\$10,000	2023 and Ongoing fuels reduction	Fire Chief and Public Works/County Old Bisbee Firewise	DFFM and other grants/donations
High	Free yard pick up one a week all year for anyone who calls for the service.	Wildfire	Staff time	Ongoing	Public Works	Public Works Budget

Table 6.35. Current Mitigation Strategy for Bisbee

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
Medium	The Town has been working with the public on high winds with flying debris. We plan to develop a public education campaign aimed at securing or eliminating items around homes and businesses that may cause damage during high wind events. Info. presented at ward meetings Info on sewer/garbage bills. Social media. City council meetings.	Severe Wind	Staff time	Ongoing	Fire and Police working Supervisors Building inspector	Public works budget
High	Implement public awareness program for possible flooding and flash floods. Educate property owners and tenants about mitigation techniques.	Flooding	Staff time \$500	Ongoing	Code Official/ County	Public Works Budget
High	Improvement and/or replacement of numerous bridge/culvert crossings of Mule Gulch Drainage Channel.	Flooding	\$2,000,000	2027	Public Works Director City of Bisbee with Contracted engineers and construction contractor.	Public works/streets and infrastructure budget. 1% tax increase. Grant money-unidentified.
High	Mule Gulch Rehabilitation This is a drainage channel that runs through the entire length of	Flooding	\$12 million	2027 for rehabilitation	City Streets and Public Works Director	Public Works Budget for cleaning and maintenance.



Table 6.35. Current Mitigation Strategy for Bisbee

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
	<p>downtown Bisbee. Sections of the retaining walls require re-engineering and replacement.</p> <p>Rehabilitation, capacity expansion and cleaning of 1.5-mile-long channel through Tombstone Canyon in Old Bisbee as a part of the Mule Gulch Drainage Project.</p> <p>Ongoing for cleaning of Mule Gulch Channel.</p> <p>Current rehabilitation has occurred only when failures occur.</p>			<p>and capacity expansion.</p> <p>Ongoing cleaning efforts.</p>	<p>Contracted engineers and construction contractor.</p> <p>City of Bisbee with Contracted Prison labor for cleaning of foliage.</p>	<p>Grants for rehabilitation and capacity expansion.</p>
High	<p>Develop a drought mitigation plan for Bisbee as guided by the Governor's Drought Mitigation Task Force.</p> <p>Working with Cochise Conservation and recharge network (CCRN) To develop a recharge basin with A+ effluent. Upgrade Wastewater filtration to produce A+ effluent.</p>	Drought	<p>\$9,000,000</p> <p>County to obtain grant money. City obligation \$500,000 an ongoing maintenance. Staff time for education.</p>	2027 and ongoing education	<p>Public Works /Director</p> <p>County Engineers</p>	<p>County grant and Public works budget.</p> <p>USDA/WIFA</p>

Table 6.35. Current Mitigation Strategy for Bisbee

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
	Individual homeowners water conservation education					
Medium	Perform an evaluation of City Hall, Library, Museum, Senior Center and Pump House buildings and infrastructure to determine infrastructure repair/replacement/ maintenance needs. And make repairs and complete maintenance. City hall needs to be rebuilt due to fire.	Building collapse/flooding	\$3,000,000 for City hall. \$125,000 Per building on average	City Hall-2025  Other essential buildings- 2027 and ongoing maintenance.	Community Development / Public Works Director	Insurance money from the fire. Donations. General funds.  Looking for grant money for ongoing maintenance and repairs.
Medium	Continue to enforce zoning and building codes through current site plan, subdivision, and building permit review processes to reduce the effects of drought, flood, severe wind, and other hazards on new buildings and infrastructure.	Drought, Flood, Severe Wind	Staff time	2027	Community Development / Public Works Director	City budget
Medium	Maintain current IGA with Cochise County Flood Control District to provide floodplain management services and review per the requirements of	Flooding	\$50,000 for a 5-year period	Ongoing	Public Works Director	City Budget

Table 6.35. Current Mitigation Strategy for Bisbee

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
	the NFIP and the City's floodplain ordinance.					
Medium	Purchase equipment to meet international border and associated terrorism related law enforcement needs including: vehicles, computers, in-car cameras, radios. Continually replacing end of useful life equipment, supplies and vehicles.	Border Security, Terrorism	\$200,000 per year	Ongoing	Police Department/Chief	City Budget and grant money
High	Review and enforce existing City of Bisbee building codes for inclusion of provisions for addressing wildfire hazards to existing and future structures and revise as needed.	Wildfire	Staff time	Ongoing	Fire department/Chief	City Budget
Medium	GIS Mapping for Fissures	Fissure	\$15,000	Ongoing updates	Cochise County engineer/ City of Bisbee public works.	City Budget
High	Building collapse due to mine settling: identify locations and neighborhoods of existing mine tunnels and analyze potential damage and mitigation options.	Building Collapse / Mine Subsidence	1,500,000	2027	Public Works /Freeport McMoran	Grant money/ City Budget/Freeport McMoRan

Table 6.36. Current Mitigation Strategy for Douglas

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)	Description
Med	Grade and line Airport Channel from International Street to 15th Street to alleviate overflow of runoff to adjacent homes. This channel is the first line of flood mitigation for runoff approaching the City from the east.	Flooding	\$2,000	2018	PW City Engineer		Partially complete. Regraded and cleared weeds 2022
High	Install backup generators at five of the City's water production wells.	Drought	\$1M	2027	PW City Engineer		In process. Currently in procurement for one generator for Well 16
Med	Construct flood control structures to address flooding that affects existing residential areas adjacent to the Palm Grove Wash drainage channel located on private property, not within a dedicated drainage easement. Improvements will include an all-weather crossing at the intersection of 18th Street and I Avenue. This is the primary access to the Fairview and Pirtleville area.	Flooding	\$2.5M	2027	PW City Engineer		In process
High	Install CSV around the reservoir and security system that will alert the city of any illegal entries and tampering. This will provide a secured facility that is connected to the city's communication center.	Border Security / Terrorism	\$1M	2021	PW City Engineer		In process
High	Prepare a city-wide master drainage plan for the identification and prioritization of all drainage and storm water improvements for the City of Douglas and contributing	Flooding	\$1.5M	2022	PW City Engineer	Grant	In process. City was awarded grant from Army Corps of Engineer to study

Table 6.36. Current Mitigation Strategy for Douglas

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)	Description
	watershed. Study will include evaluation and update recommendations for current FEMA NFIP floodplains.						Rose and Palm Grove Wash.
Med	Construction of flood control structures to address flooding and uncontrolled flow of stormwater along and through the Border Fence and International Street. Mitigation of the flooding is a necessary part of homeland security.	Flooding	\$5M	2025	PW City Engineer		In process
High	Install CCTV around the WWTP and a security system that will alert the City of any illegal entries and tampering. This will provide the City with a secured facility that will be connected to the City's communication center. The Douglas WWTP is located right at the U.S. Mexico Border.	Border Security / Terrorism	\$1M	2025	PW City Engineer		Complete. The WWTP has security cameras throughout the compound installed 2022
High	Enforcement of tie down procedures for mobile homes and other building types will be strengthened	Severe Wind	\$70,000	2027	PW City Engineer		New
High	Prepare comprehensive plan for water production in the case of long-term power outage, and demand from other systems.	Drought	\$500,000	2027	PW City Engineer		Water resiliency study conducted. Two wells are currently under design/construction and one more within the next year

Table 6.36. Current Mitigation Strategy for Douglas

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)	Description
High	Construct retention /detention basins on both sides of town to reduce flood flows going into Mexico, and to allow basic treatment of the stormwater (settling, skimming)	Flooding	\$660,000	2027	PW City Engineer		Ongoing. Phase I construction of detention basin on NW corner of Washington and Golf Course Rd.
High	Inspect derelict commercial buildings in the downtown area for safety in wind, rain, and earthquake	Severe Wind	\$500,000	Ongoing	PW City Engineer		Ongoing
High	Enforcement of tie down procedures for mobile homes and other building types will be strengthened	Severe Wind	\$70,000	2027	PW City Engineer		New
High	Prepare comprehensive plan for water production in the case of long-term power outage, and demand from other systems.	Drought	\$500,000	2027	PW City Engineer		Water resiliency study conducted. Two wells are currently under design/construction and one more within the next year
High	Construct retention /detention basins on both sides of town to reduce flood flows going into Mexico, and to allow basic treatment of the stormwater (settling, skimming)	Flooding	\$660,000	2027	PW City Engineer		Ongoing. Phase I construction of detention basin on NW corner of Washington and Golf Course Rd.
High	Inspect derelict commercial buildings in the downtown area for safety in wind, rain, and earthquake	Severe Wind	\$500,000	Ongoing	PW City Engineer		Ongoing

Table 6.37. Current Mitigation Strategy for Huachuca City

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
Medium	Continue to evaluate and enforce zoning codes, as well as adopted building codes by requiring detailed site plans be included in the building permit process to help reduce the effect of drought, flood, severe wind and other hazards on new developments and infra-structure.	All	Staff time	Ongoing	Code Official	
Medium	Maintain current IGA with Cochise County to continue the floodplain management for the Town	Flood	Staff time	Ongoing	Code Official	
Medium	Implement Vacant Building Registry to log ownership contact information on vacant buildings in case of an emergency and enforce property and building maintenance on vacant property	Severe wind, flooding, wildfire	Staff time	Ongoing	Code Official	
Medium	Develop wildfire mitigation plan in conjunction with the county-wide community fire prevention plan	Wildfire	Staff time	2024	Fire Chief	Grants
Med	Implementing wildfire fuel mitigation measures	Wildfire	\$1500 per acre	2025	Fire Chief	Grants/Budgeting/Private
Medium	Assessment of hazard mitigation needs at our wastewater facility	Flooding	Staff Time	2024	Public Works	Potential for some federal funding/staff assistance
Medium	The Town will continue with a public awareness program for possible	Flooding	Staff time	Ongoing	Public Information	

Table 6.37. Current Mitigation Strategy for Huachuca City

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
	flooding and flash floods. Educate property owners and tenants about mitigation techniques.				Officer and Code Official	
High	The Town will continue to educate the public on dangers of high winds with flying debris. We plan to develop a public education campaign aimed at securing or eliminating items around the home and business that might cause damage during high wind events.	Severe Winds	Staff time	Ongoing	Code Official	
Medium	Implement public awareness program for possible flooding and flash floods. Educate property owners and tenants about mitigation techniques.	Flooding	Staff-time		Medium	
High	The Town has been working with the public on high winds with flying debris. We plan to develop a public education campaign to secure or eliminate items around the home and business that may cause damage during high wind events.	Severe Wind	Staff-time	On-going	Fire/Police/Public Information Officer	
High	We have developed a Wildfire Plan and are currently implementing this plan in our town. We are debrushing and creating fire breaks near housing.	Wildfire	Staff-time	2025	Fire Chief and Public Works	Working on finding grant funding



Table 6.37. Current Mitigation Strategy for Huachuca City						
Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
Medium	Provide free landfill services one day each month to help reduce wildfire risk.	Wildfire	Staff-time	On-going	Landfill	

Table 6.38. Current Mitigation Strategy for Sierra Vista

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
High	Administer City-wide water conservation programs and public awareness campaigns	Drought, Fissure, Wildfire	\$50,000	Implemented and Ongoing	Director of Community Development	Grants, Enterprise Fund, General Fund
High	Continue to take pro-active lead in regional water conservation and management organizations to support regional groundwater levels and improve resiliency	Drought, Fissure, Wildfire	\$50,000	Implemented and Ongoing	Director of Public Works	Grants, Partnerships
Medium	Identify and map new flood hazard areas and update existing mapping in accordance with FEMA requirements	Flood/Flash Flood	\$150,000	Ongoing	Directors of Community Development and Public Works	Grants, General Fund
High	Operate and maintain reverse 911 for City of Sierra Vista to warn the public of emergency situations	All	\$15,000	Implemented and Ongoing	Police Chief	General Fund
High	Complete the update to the City's Surface Water Master Plan to identify areas for future drainage improvements	Drought, Flood/Flash Flood	Varies by Project	Ongoing	Director of Public Works	Grants, General Fund, Partnerships
Medium	Move a portion of the treated effluent from the City's Environmental Operations Park to the Riverstone Property to support the San Pedro River	Drought	\$6,000,000	2024	Director of Public Works	Grants, Partnerships
Medium	Keep the City's Emergency Response Plan up to date	All	\$10,000 per year	Ongoing	Fire Chief	Grants, General Fund
Medium	Invest in new brush clearing equipment for use in removing fire fuels in washes	Wildfire	\$50,000 per year	Implemented and Ongoing	Director of Public Works, Fire Chief	HURF, Grants, General Fund

Table 6.38. Current Mitigation Strategy for Sierra Vista						
Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
	or other areas where fire poses a significant hazard					
Low	Upgrade existing and install new back-up generators for crucial public infrastructure	Wind	\$500,000	Implemented and Ongoing	Director of Public Works	Grants, General Fund

Table 6.39. Current Mitigation Strategy for Tombstone

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
High/ Medium/ Low?	Water infrastructure hazard mitigation – Bridge at Camino San Rafael – Install reinforced concrete at bridge to prevent 6” water main from breaking during flash floods in Walnut Gulch.	Flash Flood / Flood	\$7,834.00	June 2023	Public Works	Water Budget
High/ Medium/ Low?	Drinking Water Improvements (SCADA) Project - A SCADA system and water improvements constructed to mitigate hazardous materials and renew liner in million-gallon reservoir tank for water supply from springs in the Huachuca Mountains.	Drought, Wildfire, Hazardous Materials	\$500,000.00	Summer of 2019	Public Works	BECC-NADB Grant
High/ Medium/ Low?	Safford Street Waterline Improvements Project- Construction of water delivery infrastructure. From Safford St. thru 10 <sup>th</sup> and along 3 <sup>rd</sup> and 6 <sup>th</sup> Streets to include a water loop & hydrants for fire service. Project is for an aging water delivery service to install 4,640 LF of 6” water main, 31 gate valves, 5 fire hydrants, & curb stop w/ flushing pipes on Safford St. This area did not have any 6” water line or fire hydrants.	Wildfire	\$481,679.00	2021	Public Works	SEAGO/ CDBG 124-20
High/ Medium/ Low?	Cactus/Mountain View Water Line Loop Project – Shovel ready. Design approx. 7,100 LF of 6” water main, laterals, valves and tie-ins and fire hydrants. This project will create a loop so the water	Wildfire	\$500,000.00	2025	Public Works	Colonias Grant or CDBG

Table 6.39. Current Mitigation Strategy for Tombstone

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
	has a continuous flow, fire hydrants and proper water pressure.					
High/ Medium/ Low?	Fire Hydrant Replacement, Repair & Removal Project – Installation of 28 fire hydrants and standpipes, valves and water lines installed all over the City of Tombstone. An initial evaluation was done and fire hydrants were not functioning properly.	Wildfire	\$339,723.22	2016	Public Works	Border-Alliance Commission Grant 2014-2016
High/ Medium/ Low?	Enforcing Building Codes to protect structures from high winds. All new structures must follow our building code.	Severe Wind	N/A	On-going	Building Official	City Funds
High/ Medium/ Low?	Educate City Residents on risks resulting from drought, wildfire, severe wind and flash flood and flooding.	Drought, Flash Flood/Flood, Severe Wind, & Wildfire	\$500.00	On-going	Public Works	City Funds
High/ Medium/ Low?	To spread the word on fire prevention, & community outreach programs, as well as social media pages to spread the word on fire prevention.	Wildfire	\$6,000.00	On-going	Fire Dept.	City Funds
High/ Medium/ Low?	Weed abatement – Fire Dept. is working with the National Firewise Association to have Tombstone recognized as a <i>Firewise city</i> & getting a program where residents can have the Fire Dept.	Wildfire	N/A	On-going	Fire Dept.	Govt. Funding

Table 6.39. Current Mitigation Strategy for Tombstone

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
	evaluate their property and help make it Firewise through a handful of options.					
High/ Medium/ Low?	Making every member of the Fire Dept. aware of mine collapse, and where the mines run in reference to the City of Tombstone. Develop plans in case a mine does collapse, the search and rescue capabilities the Fire Dept. has, and to stabilize a mine collapse and evacuate residents if the need arises.	Mine Subsidence / Building Collapse	N/A	On-going	Fire Dept.	City Funds
High	New Plan to improve and repair the City's water system to mitigate future issues with the 30 mile Aquaduct.	Wildfire, Drought, Flood/Flood	\$50,000.00	2024	Public Works	City Funds
Medium	Continuation of educational awareness regarding fire prevention in the local school system for youths as well as adults through local civic organizations; and establishment of City fire breaks through weed abatement through Firewise USA Program.	Wildfire	\$5,000.00	Ongoing	Fire Dept.	City Funds

Table 6.40. Current Mitigation Strategy for Willcox						
Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)
Low	Drainage Improvements	Flooding, Fissure	\$85,000,000	Funding Required	Managers Office	Unknown
Medium	Drainage shared use path improve drainage	Flooding	\$2,500,000	Funding Required	Managers Office	Unknown
Medium	Water capacity studies redundancy	Drought Flooding, Fissure	\$5,000.0000	Funding Required	Managers Office	Unknown
High	Natural Gas (high-pressure conveyance) replacement	Earthquake Flooding, Fissure	\$9,500,000	Funding Required	Managers Office	US DOT

## SECTION 7: PLAN MAINTENANCE PROCEDURES

According to the DMA 2000 requirements, each plan must define and document processes or mechanisms for maintaining and updating the hazard mitigation plan within the five-year planning cycle. Elements of this plan maintenance section include:

- Monitoring and Evaluating the Plan
- Updating the Plan
- Implementing the Plan by Incorporation into Other Agency or Jurisdictional Planning Mechanisms

Cochise County and the participating jurisdictions recognize that this hazard mitigation plan is intended to be a “living” document with regularly scheduled monitoring, evaluation, and updating. The Cochise Office of Emergency Management recognizes that it is in the County’s best interest to keep the plan in the forefront of the whole community between the planning cycles.

### 7.1 Monitoring and Evaluation

During the 2022 Plan update process, it was clear that not all of the planned improvements to the monitoring and evaluation process were successfully implemented. The Planning Team has established the following monitoring and evaluation procedures:

- Schedule – The Plan shall be reviewed on at least an annual basis. The Cochise County Office of Emergency Management will contact each jurisdiction’s point of contact or the City/Town Manager/Clerk to coordinate the Plan review. After the 2017 Plan revisions, this did not happen due to staff turnover.
- Review Content – The Team agreed to revise the scope and content of annual review meetings for the 2022 plan. The content and scope of the Plan review and evaluation will address the following questions:
  - *Hazard Identification: Have the risks and hazards changed? Have any events of significance occurred within the identified or in other hazards?*
  - *Goals and Objectives: Are the goals and objectives still able to address current and expected conditions?*
  - *Grant Funding: Have any jurisdictions received grants through FEMA programs or secured other relevant funding sources?*
  - *Mitigation Projects and Actions: Have any projects been completed? Are there changes to actions or projects?*
  - *Collaboration: Are there any opportunities for jurisdictions to collaborate on any actions or projects?*
  - *Public Outreach: What activities are taking place? What more can the jurisdictions be doing?*

In preparation, each jurisdiction will review its progress toward the Plan annually for discussion during this annual review. Documentation of the annual review will include a compilation of notes on discussions and conclusions. The next plan revision will include copies of the yearly review summaries.



## 7.2 Plan Update

According to DMA 2000, the Plan requires updating and approval from FEMA every five years. The plan updates will adhere to that set schedule using the following procedure:

- ✓ Approximately one year before the plan expiration date, the Cochise County Office of Emergency Management, or their designated planning consultant, will update the revision process for the next Plan cycle.
- ✓ The Cochise County Office of Emergency Management will work with the ADEMA Division of Emergency Management's Planning Section on any FEMA or State requirements for the revision.
- ✓ The revised Plan document will be presented before the respective councils and boards for official adoption of the changes.
- ✓ As required, the revised plan will be submitted to ADEMA and FEMA for review, comment, and approval.

## 7.3 Incorporation into Existing Planning Mechanisms

Incorporating this Multi-Jurisdictional Hazard Mitigation Plan into other planning mechanisms, either by content or reference, enhances a community's ability to perform natural hazard mitigation by expanding the scope of the Plan's influence. The Team was polled on how the plan was utilized in any preparedness, mitigation, response, or recovery activities since the 2017 revision. Team members felt that they had worked on some of the prior Plan's mitigation actions but were unaware that they were from the Mitigation Actions in the plan. This was again due to the amount of turnover, not only at the County but also at the local jurisdictional level.

Through the Milestone planning meetings for the current revision, the consultant, AZDEMA representatives, and the Cochise County Office of Emergency Management emphasized the importance of keeping the plan active over the five-year cycle. The interactivity between mitigation planning, land use planning, development plans, community preparedness activities, and community lifelines was emphasized.

Ways to use and incorporate the Plan over the next five-year planning cycle, discussed by the Planning Team, included:

- Use of, or reference to, Plan elements in updates to general and comprehensive planning documents, codes, and ordinances.
- Addition of defined mitigation actions to capital improvement programming.
- Inclusion of Plan elements into development and retrofitting planning and practices.
- Resource for developing or updating emergency operations plans, community wildfire protection plans, emergency response plans, etc.
- Use the annual evaluations to keep the Plan awareness elevated and ensure that appropriate stakeholder lists are maintained.

Specific ways in which the 2017 Plan was incorporated or referenced into other planning mechanisms for each jurisdiction are summarized below:

#### Cochise County:

- Information was updated on the county website, and public input was welcomed.
- Attended community meetings throughout the year and seasonally to host discussions on the Ready, Set, Go Program; Firewise; and personal preparedness to build resilient communities.
- Hand out information at local fairs and public events such as Farmer's Markets.
- Added the quarterly radio show with the Sheriff's office to discuss signing up for alerts and details on the Ready, Set, Go Program in case of evacuations.

#### City of Benson:

- Community outreach at events on wildfire mitigation and preparedness activities.

#### City of Bisbee

- News articles in local papers,
- Council meetings and calls to the public,
- NPR podcasts,
- Public meetings,
- Media interviews and social platform postings, and
- Public notice of plan revision.

#### City of Douglas:

- Posted to social media in April 2017 to solicit public input through a link to the Cochise County website. Comments were also solicited from Department Directors.
- Presented to the Mayor and Council for adoption in September 2017.
- No activities to report following the Plan adoption in September 2017.

#### Town of Huachuca City:

- Information on the Plan was shared on Town's website.
- The Town Newsletter shared information on seasonal mitigation topics related to flooding and fire risks/mitigation.
- Information on seasonal risks (weather, fire, winds) was shared on social media pages, including information provided by Cochise County.

#### City of Sierra Vista

- Opportunity for input on the Plan posted on the City's website.
- Information about the Plan is shared on social media.
- Shared information in the City's Vistas newsletter about hazard mitigation topics seasonally (managing overgrowth, being FireWise, illegal dumping and its impacts on drainageways and flooding, etc.)
- Targeted social media on immediately relevant topics (extreme weather in the forecast, road closures, etc.)

#### City of Tombstone

#### City of Willcox

- Integrated mitigation activities and promotion in:
  - Project-related community meetings,
  - Health and welfare community event,
  - Reclaimed water discussions,
  - Utility awareness annual meeting and
  - Downtown revitalization planning through the EPA.

The Plan will continue to function as a standalone document subject to its review and revision schedule. The Plan will also serve as a reference for other mitigation and land planning needs of the participating jurisdictions. Whenever possible, each jurisdiction will incorporate the risk assessment results, mitigation actions, and actions identified in the Plan into existing and future planning mechanisms. Specific incorporation of the Plan risk assessment elements into the natural resources and safety elements of each jurisdiction's general plans (or in the County Comprehensive Plan), and development review processes, adding or revising building codes, adding or changing zoning and subdivision ordinances, and incorporating mitigation goals and strategies into general or comprehensive plans, will help to ensure hazard mitigated future development.

### **7.4 Continued Public Involvement**

The Planning Team reviewed the public involvement documented in the 2017 Plan and discussed the challenges and successes regarding the identified continued public involvement strategy. It was noted that public education and outreach relating to the hazards faced by communities is an ongoing effort. Some participating jurisdictions specifically identified activities related to public education and outreach efforts along with their vulnerability assessments in Section 6.

The biggest gap identified for ongoing public involvement is the need for annual plan reviews with the jurisdictions. To fill this need, public outreach has been added as a discussion topic for the annual review meetings. Following these meetings, the County will post a summary along with the ability to comment on the page where the current version of the MHMP is linked.

In addition, some jurisdictions provided additional opportunities for continued public involvement relating to the MJHMP:

#### Cochise County

- Continue working with Public Health and share messaging on long-term care facilities having safety plans and evacuation plans and exercising them in the event of a wildfire or flooding disaster.
- Conduct yearly outreach to local Junior high and high schools, teaching personal preparedness and awareness of mitigation and preparedness activities.

- Produce quarterly newsletters for the county website for EM to share with the Board of Supervisors and community members on emergency mitigation, preparedness, response, and recovery activities.
- Provide mitigation brochures at public events.
- Hold annual mitigation review meetings as described in this document.

#### City of Benson

- Work with the proposed developments to mitigate the wildland urban interface and with possible flooding issues.

#### City of Bisbee

- Firewise inclusion for educational opportunities as well as Firewise assessment certification.
- Public Notice of plan revision for the 2022 plan.
- Have the Fire Department educate on mitigation activities in the school safety program.
- Local public radio public announcements and special informational programming.
- Council meetings and calls to the public.
- News articles in local papers.
- Open door policy with Public Works questions and answers on projects.

#### City of Douglas

- Use social media platforms to solicit public comment from community members and stakeholders.
- Town Hall presentations on progress along with annual updates to elected officials.

#### Town of Huachuca City

- Continue to post information on the mitigation process on the Town's website.
- Share information about the completed Plan on the Town's website and social media.
- Continue to share information on seasonal risks (fire, flood, wind) on Town's website, social media page, and through the newsletter.
- Brief Town Council members and staff on the adopted plan.

#### City of Sierra Vista

- Opportunity for input into Plan posted on the City's website.
- Information about the adopted plan shared on social media.
- Continue sharing information in the City's Vistas newsletter about hazard mitigation topics seasonally (managing overgrowth, being FireWise, illegal dumping and its impacts on drainageways and flooding, etc.)
- Use social media to deliver information on immediately relevant topics (extreme weather in the forecast, road closures, etc.)

#### City of Tombstone

#### City of Willcox

- Integrate mitigation activities and promotion in:
  - Emergency Preparedness Taskforce (Planning Group)
  - Annual Briefing Council, Boards and Commissions
  - Community Outreach and Education
  - Funding Public Forums

## SECTION 8: PLAN TOOLS

### 8.1 Acronyms

ADEMA	Arizona Department of Emergency & Military Affairs
ADEM	Arizona Division of Emergency Management
ADEQ	Arizona Department of Environmental Quality
ADFFM	Arizona Department of Forestry and Fire Management
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AGFD	Arizona Game and Fish Department
ARS	Arizona Revised Statutes
ASCE	American Society of Civil Engineers
AZDPS	Arizona Department of Public Safety
AZGS	Arizona Geological Survey
BLM	Bureau of Land Management
BRIC	Building Resilient Infrastructure and Communities
CFR	Code of Federal Regulations
CLIMAS	Climate Assessment for the Southwest
CPRI	Calculated Priority Risk Index
CRS	Community Rating System
CWPP	Community Wildfire Protection Plan
DFIRM	Digital Flood Insurance Rate Map
DMA 2000	Disaster Mitigation Act of 2000
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
FEMA	Federal Emergency Management Agency
FMA	Flood Mitigation Assistance Grant Program
GIS	Geographic Information System
HAZUS	Hazards United States Multi-Hazard
HMGP	Hazard Mitigation Grant Program
IFCI	International Fire Code Institute
LEPC	Local Emergency Planning Committee
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
MMI	Modified Mercalli Intensity
NCEI	National Center for Environmental Information
NDMC	National Drought Mitigation Center
NESDIS	National Environmental Satellite, Data and Information Service
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NSF	National Science Foundation
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWCG	National Wildfire Coordination Group
NWS	National Weather Service
PDM	Pre-Disaster Mitigation Grant

REPI	Readiness and Environmental Protection Integration
RFC	Repetitive Flood Claims Program
RL	Repetitive Loss
SARA	Superfund Amendments and Reauthorization Act
SRLP	Severe Repetitive Loss Properties
SRL	Severe Repetitive Loss
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USDOT	United States Department of Transportation
USFS	United States Forest Service
USGS	United States Geological Survey
WUI	Wildland Urban Interface

## **SECTION 9: Appendixes**



### **9.1 Appendix A: Official Resolutions of Adoption**

(Insert in final document)

## **9.2 Appendix B: Planning Process Documentation**



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## Hazard Mitigation Plan Update Meeting #I

April 05, 2022

**3:00 p.m.**

Welcome & Introductions

Hazard Mitigation Planning Overview

- Plan Purpose and Benefits
- DEMA's Involvement

Planning Process

- Five Stages of Plan Development
- Timeline

Expectations of the Planning Team

- Point of Contact
- Assignments

Assignment Overview

- Public Notification
- Community Descriptions
- Public and Stakeholder Involvement
- Expectations and Action Items

Cochise County Planning Team Overview

- Jurisdictional Representatives
- County Contacts
- Next Meeting
- Expectations and action items

**5:00 p.m.** Adjourn

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## **Hazard Mitigation Plan Update Milestone Meeting #1**

May 11, 2022

**3:30 p.m.**

Welcome & Introductions

Expectations of Team Members

Milestone #1 Assignments

- Community Descriptions
- Public Information and GIS Requirements and Needs
- Ongoing Planning Meetings Outline

Questions and Next Meeting

**5:00 p.m.** Adjourn

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## Hazard Mitigation Plan Milestone Meeting #2

June 6, 2022

11:00 am.

Welcome

Hazard Mitigation Progress Update

- Community Descriptions
- Public Outreach
- Planning Team
- Five Stages of Plan Development

Risk Assessment

- Hazards in Current Plan
- Hazard Profile Updates
- Description
- History
- Extent
- Probability
- Vulnerability
- NFIP
- Changes in Development

Review Assignment #2

Progress Timeline

Next Meetings

12:30 p.m. Adjourn

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## **Multijurisdictional Hazard Mitigation Plan Revision – Jurisdictional Hazard Review**

June 27, 2022

**10:00 am.**

- Welcome – Courtney & Tammi-Jo
- Hazard Mitigation Progress Update
- Community Descriptions
- Public Outreach
- Planning Team
- Risk Assessment
- National Risk Index Overview
- Discuss Additional Hazards
- Hazards in Current Plan
- Hazard Profile Update Status
- Review of Current Hazards
  - CPRIs for Each Hazard
- Progress Timeline
- Next Meetings

**12:00 p.m.** Adjourn

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## **Multijurisdictional Hazard Mitigation Plan Revision – Mitigation Actions Milestone # Introduction**

July 25, 2022

**10:00 am.**

- Welcome – Courtney & Tammi-Jo
- Hazard Mitigation Progress Update and Timeline
- Review of Missing Items for Milestones #1 and #2
- Review of Milestone #3 Assignments
  - NFIP
  - Capabilities
  - Past Mitigation Actions
  - New Mitigation Actions
- Quick Review of the Hazard/Risks Updates
- In Person Meeting Scheduled Next Month
- Questions?

**12:00 pm** Adjourn

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## Multijurisdictional Hazard Mitigation Plan Revision – Mitigation Actions

August 23, 2022

Sierra Vista Police Department Auditorium,  
911 Coronado Dr, Sierra Vista, AZ 85635

RSVP to [cbearmjhmp@gmail.com](mailto:cbearmjhmp@gmail.com) if you are coming in person – Light lunch will be provided. Remote access through Teams is also available.

**11:00 am.**

- Welcome – Courtney & Tammi-Jo
- Hazard Mitigation Progress Update
- Community Description Update (See Assignment #1)
- Public Outreach Update
- Risk Assessment Update (See Assignment #2)
  - Discussion on Dams and Dam Failures as a Hazard/Risk
  - Review of Jurisdictional CPRIs
  - Designate Priority Hazards
  - Status of Hazard and Risk Revisions
- Mitigation Actions (See Assignments #3)
  - Review of Mitigation Goals and Objectives
  - NFIP Compliance Worksheet
  - Capabilities
  - Update Previous Mitigation Actions
  - Develop New Mitigation Strategies
- Progress Timeline
- Next Meetings

**1:00 pm** Adjourn

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## **Multijurisdictional Hazard Mitigation Plan Revision – Final Planning Meeting**

October 27, 2022

Teams Meeting – no live meeting

**1:00 pm**

- Welcome – Courtney & Tammi-Jo
- Update on Assignment 1 – Planning and Community Descriptions
  - Planning Activities
  - Community Descriptions
- Planning Team Members and Leads
- Assignment 2 – Hazards and Risks
- Assignment 3 – NFIP, Capabilities, Past and New Mitigation Actions
- Plan Adoption, Maintenance, and Implementation
- Questions and Next Steps

**2:30 pm** Adjourn

---

0 Sign in 6/27 mJHMP meeting phone

Tammi Jo Wilkins	OES	520 366 6610
Conny Bear	Consultant	520-982-6744
Jim Adams	TOMMISONE	520 249 7837
LAWRENCE BOUTTE	SVPO	520 732-7170
JOAQUIN SOLIS	Cochise City	520-432-9317
Bradley Simmons	Cochise County	520-432-9371
Valarie Fuller	Cochise County	520-432-9321
Daniel S. Ducken	Cochise County	(520) 432-9219
TERRY COUCHENOUR	Cochise	520 432 8336

→ Teams

Ken Droz weather

Mike Allen Red Cross

Ken Foster - CCSO

Sharon FLISSAR - SV

Brad Hamilton

Jim Harms Red Cross

Kevin Lomeli Douglas Fire

Daisy Dema

(20)

Mike Shepton

Dale Hladfield Wilcox PD/Fire

Camila Rochon CC PIO

Marty Flaherty CC Roads

Paul Espurza

Jacquie Clay

Debra Prow

Erin Saffell

26 Brad Hamilton

Sign in 6/27 mJHMP meeting phone

Terrence J. Wilkins	OES	520 366 6610
Constance Bear	Consultant	520-982-6744
Jim Harms	TOMASSONE	520 249 7837
LAWRENCE BOUTTE	SVPO	520 732-7170
Joaquin Solis	Cochise City	520-432-9317
Bradley Simmons	Cochise County	520-432-9371
Valarie Fuller	Cochise County	520-432-9321
Daniel S. Ducken	Cochise County	(520) 432-9219
Terry Couchenour	Cochise	520 432 8336

→ Teams

Ken Droz weather

Mike Allen Red Cross

Ken Foster - CCSO

Sharon FLISSAR - SV

Brad Hamilton

Jim Harms Red Cross

Kevin Lomeli Douglas Fire

Daisy Dema

Mike Shepton

Dale Hadfield Wilcox PD/fire

(20) Camila Rochem cc PIO

Marty Hawerty cc Roads

Paul Esparza

Jacquie Clay

Debra Prow

Erin Saffell

26 Brad Hamilton

Hmra Update meeting 7/25/2022

Alex Dema	Sabrina Anderson
Joe Casuy	Beth Robinson
Terry IT	Ron Gonsalves
EIKE Remeikis	Joaquin Solis
ERin Saffell	Alicia Thompson
Val Fuller	Jackie Watkins
Jim Harms	Xavier ARMendariz
Marty Haverly	Brad Hamilton
Josh Henson	Mike Hammarstrom
Ken DR20d	Kris Carlson
Lindsey Koehler	
Mike Allen	
Mike Shelton	
Kim Mitchell	

Milestone #3  
8/22/

Sign-in

Tammi Jo Wilkins  
Bradley Simmons  
Dorell Duchon

KRAIG FULLER

Valarie Fuller

LINDSAY KOEHLER  
Cooper Raphael

Ken Drozd

Kate Gullet

Courtney Bear

MARK SAVANE

Jim Thizz

Sharon Flissar

~~Pat Johnson~~

Jackie Watkins

Denille Boachever

Lu Hernandez

Amber Morin

Shon Brady

Josh Henson

Kevin Lomeli

Mike Shelton

Kim Mitchell } Health

Beth Robinson

Elke Remelkes - City of Tombstone

Matthew Gurney

City of Bisbee

CCDEM

CC Engineering and Natural Resources

CCDEM

Douglas P.D.

Cochise County ENR

Old Bisbee Firewise

"

NWS Tucson

NWS Tucson

Cochise Consult

FED / HCD

HEPD /

CASH

Town of Archaia City

Cochise County

City of Bisbee

AZ Demo

Douglas Fire

Red Cross

AZ Demo

Cochise County

Jim Harms

Alex Macoe

TERRY COUCHENOUR

28  
29

### **9.3 Appendix C: Public Involvement Records**





## Multi-Jurisdiction Hazard Mitigation Plan

Home - Departments - Emergency Management - County Emergency Plans - Multi-Jurisdiction Hazard Mitigation Plan

### Multi-Jurisdiction Hazard Mitigation Plan

Welcome to the project webpage for the 2022 revision of the Cochise County Multi-Jurisdictional Hazard Mitigation Plan. Please check back for ongoing project updates and postings.

#### What is Hazard Mitigation?

FEMA defines hazard mitigation as sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects. This encompasses natural hazards or disasters such as floods, hurricanes, wildfires, landslides, tsunamis, earthquakes, dam failures, or other natural hazards. As the cost of disasters continues to rise, governments and citizens must find ways to reduce hazard risks to the whole community (defined). Efforts to reduce hazard risks are easily intertwined with other community goals. As communities plan for development and improvements to existing infrastructure, mitigation is vital for the planning effort.

While mitigation activities are taken before a disaster by definition, consideration of mitigation efforts is essential after a disaster. After a disaster event, infrastructure is often repaired or replaced to pre-disaster conditions. These efforts may return things to normal but result in a repetitive cycle of damage, reconstruction, and repeated damage as the hazard strikes again and again. Hazard mitigation breaks the cycle by producing less vulnerable conditions through post-disaster repairs and reconstruction and other efforts to reduce the impact of the disaster on the people and property. Implementing hazard mitigation actions by local, state, and federal governments and private entities means stronger, safer, and smarter communities with a reduction in future injuries, deaths, and damages.

#### About This Project

Cochise County updated the previous MHPMP under the requirements of the Federal Stafford Act, the National Flood Insurance Act, and 44 Code of Federal Regulations. The last plan was approved and adopted by the Arizona Division of Emergency Management (ADEM), the Federal Emergency Management Agency (FEMA), Cochise County, and participating jurisdictions in 2017.

Cochise County and participating jurisdictions will benefit from this revision by:

- Ensuring eligibility for all sources of hazard mitigation funds made available through FEMA.
- Increasing public awareness and understanding of vulnerabilities and support for specific actions to reduce losses from future natural disasters.
- Ensuring community policies, programs, and goals are compatible with reducing vulnerability to all hazards and identifying incompatible ones.
- Building partnerships with diverse stakeholders to leverage data and resources to reduce workloads and achieve shared community objectives.
- Expanding the understanding of potential risk reduction measures, including local plans and regulations, structure and infrastructure projects, natural systems protection, education and awareness programs, and other tools for a resilient community.
- Informing the development, prioritization, and implementation of mitigation projects as benefits accrue over the life of a project as losses are avoided from subsequent hazard events.

#### Project Outreach and Communications

The Cochise County Office of Emergency Management Services is leading this project for the County and wants to ensure that all community stakeholders and citizens have an opportunity to be involved in the planning process. All project information and messaging will be posted utilizing this website for the life of this current revision project in 2022.

#### Project Schedule

The following is the proposed project schedule:

- April 2022: Project Kick-Off Meeting
- May 2022: Milestone 1: Community Description, Planning Team Development, Public Outreach
- June 2022: Milestone 2: Risk Assessment
- August 2022: Milestone 3: Mitigation Strategy
- September 2022: Milestone 4/5: Plan Maintenance and Implementation
- October 2022: Plan Draft Development and Local Approval
- November 2022: Plan to DEM and FEMA for Approval
- December 2022: Begin Plan Adoptions Locally

#### Plan Documents

The current 2017 plan can be found [here](#).

#### Relevant Links

- [2022 State of Arizona Hazard Mitigation Plan](#)
- [FEMA Hazard Mitigation Planning](#)
- [FEMA Hazard Mitigation Grant & Assistance Grant Programs Summary](#)
- [FEMA Mitigation Planning YouTube Playlist](#)

#### Public Comment

As part of the planning process, the public is welcome to provide input on the 2022 Multi-Jurisdiction Hazard Mitigation Plan. Use the comment form below to submit your feedback.

#### Community Feedback Form

##### Overview

Cochise County residents are encouraged to provide feedback on the Multi-Jurisdiction Hazard Mitigation Plan. Please submit your comments in the feedback form below.

Comments:



☒ Receive an email copy of this form

Email address

This field is not part of the form submission.

Submit







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The Sunset City

### Hazard mitigation plan update underway

Cochise County updated the multi-jurisdictional planning team and revised the 2017 Cochise County Multi-Jurisdictional Hazard Mitigation Plan following a public input process earlier this year. Feedback will be incorporated into the updated plan, slated for local adoption in December 2022.

The effort is being conducted in accordance with the Disaster Mitigation Act of 2000, which requires all local, county, tribal, and state governments to have a FEMA-approved hazard mitigation plan to be eligible for federal disaster mitigation funds.

The mitigation plan aims to aid Cochise County and participating jurisdictions by ensuring eligibility for hazard mitigation funds through FEMA, increasing public awareness, reducing vulnerability to natural disasters, building partnerships, and more.

Visit the [project page](#) on the Cochise County website for ongoing project updates and postings.

More: [City News](#)

## Multi-Jurisdictional Hazard Mitigation Plan

Posted on October 7, 2022 by Suzanne Harvey

The Cochise County multi-jurisdictional planning team is in the process of revising the 2017 Cochise County Multi-jurisdictional Hazard Mitigation Plan. The Town of Huachuca City, along with other county municipalities, is participating in the revision process. The updated plan is slated for local adoption in December 2022. The Disaster Mitigation Act of 2000 requires all local, county, tribal, and state governments to have a FEMA-approved hazard mitigation plan to be eligible for federal disaster mitigation funds.

Once adopted, the Cochise County Multi-jurisdictional Hazard Mitigation Plan will ensure that Huachuca City, Cochise County and other participants remain eligible for those funds should the need arise. In addition the mitigation plan, will aid Cochise County, Huachuca City and other municipal partners by building public awareness, reducing vulnerability to natural disasters, and building partnerships.

Visit the Cochise County website, [Multi-Jurisdiction Hazard Mitigation Plan | Cochise County, AZ](#), for more information.

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## City of Tombstone Hazard Mitigation Plan

For Immediate Release:  
POC: Elise Kemnitz-Hanna  
PH: 1 (520) 457-3415  
E-Mail: [publicworks@cityoftombstone.gov](mailto:publicworks@cityoftombstone.gov)

City of Tombstone  
Department of Public Works

### CITY TO BEGIN WORK ON HAZARD MITIGATION PLAN UPDATE

A planning team comprised of representatives from the City of Tombstone, Cochise County, the participating Cochise County Cities, will be meeting regularly via Microsoft Teams meetings and at times in person in Sierra Vista to participate in a county-wide hazard mitigation planning update process. The purpose of this is to update the current hazard mitigation plans for the participating communities, previously approved by the Federal Emergency Management Agency (FEMA). According to the Disaster Mitigation Act of 2000 (DMA2K), local, county, tribal and state governments are required to have a FEMA approved hazard mitigation plan in order to be eligible for federal disaster mitigation grant funds. The plan focuses on the area's

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### Hazard mitigation plan update underway

**Post Date:** 08/23/2022 2:45 PM

Cochise County updated the multi-jurisdictional planning team revised the 2017 Cochise County Multi-jurisdictional Hazard Mitigation Plan following a public input process earlier this year. Feedback will be incorporated into the updated plan, slated for local adoption in December 2022.

The effort is being conducted in accordance with the Disaster Mitigation Act of 2000, which requires all local, county, tribal, and state governments to have a FEMA-approved hazard mitigation plan to be eligible for federal disaster mitigation funds.

The mitigation plan aims to aid Cochise County and participating jurisdictions by ensuring eligibility for hazard mitigation funds through FEMA, increase public awareness, reducing vulnerability to natural disasters, building partnerships, and more.

Visit the [project page](#) on the Cochise County website for ongoing project updates and postings.


[Return to full list >>](#)


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Posted on: June 15, 2022
Hazard Mitigation Plan
<https://www.douglasaz.gov/DocumentCenter/View/5143/Hazard-Mitigation-Plan-5722>

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Plans, Studies, Reports & Comprehensive Documents

### Plans, Studies, Reports & Comprehensive Documents

- Capital Improvement Plan FY 06-07
- City Seal Plan with Proclamation and Emblems (7/2015)
- Comprehensive Transportation Plan Book
- City of Bisbee General Plan Update Report 2015
- Final ULI (Urban Land Institute) Arizona / City of Bisbee TAP Summary Report 09/2015
- General Plan Volume I Data and Analysis Updated June 2014
- General Plan 2015 Volume II Implementation (Goals & Policies) Updated and Re-Adopted September 1 2015
- Impact Fee Study (Draft)
- Land Use Maps 2015
- City of Bisbee Charter
- Parks Master Plan
- San Jose Charter
- Senior Care Facility Feasibility Study 12/22/2014
- Bidback Enhancement Plan
- City of Bisbee Action Plan (February 2017)
- Multi-Jurisdiction Hazard Mitigation Plan - Cochise County
- City of Bisbee Sustainability Plan
- 2018 Voter/Referendum Study - WILLCOX
- Cochise County FY2006-2010 Strategic Marketing Plan (8/20/2006)
- County Info. MacGowan completed Library Building Condition Assessment 05/2001
- Shared Use Path Feasibility Study Final Report Kimery Horn (July 8, 2021) the Mayor and Council Approved Plan B and to look for funding).





## News Release

FOR IMMEDIATE RELEASE:  
June 7, 2022

Camila Rochin  
Public Information Officer  
crochin@cochise.az.gov  
520.432.9214

### **Cochise County Seeks Public Input On 2022 Multi-Jurisdictional Hazard Mitigation Plan**

**BISBEE, Ariz. (June 7, 2022)** – Cochise County, along with the seven (7) incorporated cities and towns, seeks public comment on the proposed 2022 Multi-Jurisdictional Hazard Mitigation Plan.

Cochise County has reconvened a multi-jurisdictional planning team comprised of representatives from Cochise County, City of Benson, City of Bisbee, City of Douglas, City of Sierra Vista, City of Tombstone, City of Willcox, the Town of Huachuca City, and other local, State, and Federal agencies to collaborate on revising and updating the county's Hazard Mitigation Plan.

As part of the hazard mitigation planning process, the planning team is tasked with identifying natural and human-caused hazards that are likely to occur in our community, assessing the existing vulnerability to these hazards, and establishing goals, actions, and projects that mitigate the associated risks. The overall plan provides communities with a clear understanding of the risks we face, and it outlines a strategy for reducing those risks and preventing community losses due to future hazards.

The multi-jurisdictional planning team is revising the 2017 Cochise County Multi-Jurisdictional Hazard Mitigation Plan and is seeking public comment throughout the process. County citizens and stakeholder groups are encouraged to provide feedback by submitting comments through the "[Community Feedback Form](#)" on the Multi-Jurisdictional Hazard Mitigation Plan webpage.

The planning effort is being conducted in accordance with the Disaster Mitigation Act of 2000, which requires all local, county, tribal, and state governments to have a FEMA-approved hazard mitigation plan to be eligible for federal disaster mitigation funds.

Learn more information about the Multi-Jurisdiction Hazard Mitigation Plan process by visiting [www.cochise.az.gov/853/Multi-Jurisdiction-Hazard-Mitigation-Pla](http://www.cochise.az.gov/853/Multi-Jurisdiction-Hazard-Mitigation-Pla).

###

#### **About Cochise County**

Cochise County provides regional leadership and effective, high-quality services with personal and professional integrity. Located in the southeast corner of Arizona, Cochise County has natural beauty, world-famous history, and fascinating culture. Covering 6,219 square miles, and with a population of approximately 130,000 people, the County provides vital services to the unincorporated areas of the region. It is home to a diverse range of incorporated cities, including Sierra Vista, Bisbee, Benson,

Appendix Table C.1. Public Comments From Initial Revision Notice		
Submission Date	Comments:	Answer:
6/7/2022	Good to see this in the works. I am so proud of our communities and their amazing leaders. I do have a comment. I know hazards are probably well covered in your discussion, but I think in every hazard there is a potential of not having potable water and long shelf life food, warm blankets, hygiene kits and basic OTC medicine. If that can be worked into the overall plan, I am sure local churches and other non-profits would be happy to provide, package and even securely store these items for emergencies.	These are response activities, and the County Office of Emergency Management has noted this comment for applicability to the Emergency Response and Recovery Plan. This plan is for actions taken before disasters to prevent loss of life and property. Potable water and the organization of community partners are vital preparedness activities.
6/8/2022	Add CPRI for Hazardous Materials. At least 34 incidents. 41 injuries, 5 fatalities, \$640,000+ in damages to 30% of total volume of all traffic through the state (ADOT, 2013) CPRI calculated in 2017 = 2.69	The County and Planning Team chose to remain with natural hazards for this plan. Hazardous materials incidents are handled through the County Local Emergency Response Committee Hazardous Materials Plan. It was decided that adding Hazardous Materials to the Mitigation Plan would be duplicative of the efforts of the LEPC and also within the County Emergency Response and Recovery Plan.

#### **9.4 Appendix D: Historical Hazard Mitigation Projects**

**Table 6-1: PAST Mitigation Strategy for Cochise County**

<b>Priority Ranking</b>	<b>Description</b>	<b>Hazard(s) Mitigated</b>	<b>Estimated Cost</b>	<b>Anticipated Completion Date</b>	<b>Project Lead</b>	<b>Potential Funding Source(s)</b>	<b>Notes</b>
High	Provide hazardous materials awareness training to all County employees who work outside the conventional County facilities, to include Sheriff personnel, Highways personnel and others as identified	HAZMAT	\$5,000 per year	Annually	Office of Emergency Services/Risk Management - Directors		Done annually. Hazardous Materials no longer in the plan
Medium	Evaluation of impact on flooding and county services resulting from unregulated lot splitting in unincorporated Cochise County.	Flooding	\$100,000	2024	Planning & Zoning Division-Director		No progress made Lower priority due to economic downturn and working on cleanup after recent flooding events
Medium	Cochise County Drought Relief Plan Development of drought mitigation plan for Cochise County as directed by the Governor's Drought Mitigation Task Force.	Drought	\$250,000	2019	Cochise County Emergency Services		Continue drought mitigation measures through the Water Conservation Office for Cochise County as directed by the Governor's Drought Preparedness Plan. Removed as duplicate

**Table 6-1: PAST Mitigation Strategy for Benson**

<b>Priority Ranking</b>	<b>Description</b>	<b>Hazard(s) Mitigated</b>	<b>Estimated Cost</b>	<b>Anticipated Completion Date</b>	<b>Project Lead</b>	<b>Potential Funding Source(s)</b>	<b>Description</b>
High	Drainage Study and Mapping of City Flood Plains. Floodplain mapping will be compliant with NFIP requirements.	Flooding	\$150,000	2020	Public Works	CIP	Funds not available
Medium	Enforcement program to enforce recently added provisions to City building codes to address building settlement and collapse problems.	Building Collapse / Mine Subsidence	\$10,000	2020	Development Services	General Fund	Removing, ongoing
Low	Union Street Wash Crossing: improve existing culvert crossing to provide additional capacity to provide improved access to the only access to neighborhood area in times of flooding.	Flooding	\$100,000	2021	Public Works	CIP / Grant /	Removing
Low	Obtain brush chipper to help reduce fuel in the city limits	Wildfire	\$150,000	2020	Public Works	CIP	Remove. Other actions.

**Table 6-1: PAST Mitigation Strategy for Bisbee**

<b>Priority Ranking</b>	<b>Description</b>	<b>Hazard(s) Mitigated</b>	<b>Estimated Cost</b>	<b>Anticipated Completion Date</b>	<b>Project Lead</b>	<b>Potential Funding Source(s)</b>	<b>Notes</b>
High	Construction of bank stabilization and culvert improvements along 1/4 mile long reach of Santa Cruz Wash in southwest Bisbee.	Flooding	\$.3 M	2022	Public Works		Completed
High	GIS Mapping for Fissures	Fissures	\$15K	2022	City Engineering		Removed since the County is working on this.
High	Public awareness and planning project to identify high-risk populations and educate the population on earthquake-resistant modifications they can make to their homes or businesses.	Earthquake	Staff Time	2022	Public Works		Completed and continued with other programs

**Table 6-1: PAST Mitigation Strategy for Douglas**

<b>Priority Ranking</b>	<b>Description</b>	<b>Hazard(s) Mitigated</b>	<b>Estimated Cost</b>	<b>Anticipated Completion Date</b>	<b>Project Lead</b>	<b>Potential Funding Source(s)</b>	<b>Description</b>
High	Install CSV around the reservoir and security system that will alert the city of any illegal entries and tampering. This will provide a secured facility that is connected to the city's communication center.	Border Security / Terrorism	\$1M	2021	PW City Engineer		Hazard not in plan and redundant with another activity in the 2017 which was kept.

**Table 6-1: PAST Mitigation Strategy for Sierra Vista**

<b>Priority Ranking</b>	<b>Description</b>	<b>Hazard(s) Mitigated</b>	<b>Estimated Cost</b>	<b>Anticipated Completion Date</b>	<b>Project Lead</b>	<b>Potential Funding Source(s)</b>	<b>Description</b>
High	Administer City-wide water conservation programs and public awareness campaigns. Also, continue to take a pro-active lead in regional water conservation and management organizations.	Drought	\$20,000	Starting 7/1/17, Ongoing	Public Works		Ongoing. Kept in new plan and divided into two different strategies.
High	Purchase containment materials such as sand, absorbent litter and containment “pigs” for HAZMAT spills	HAZMAT	\$50,000	Starting 7/1/17, Ongoing	Fire Chief, Public Works Director		Deleted. HAZMAT not included as a natural hazard in new plan.
Medium	Coyote Wash Flood Control Project Phase 1 (Coronado Site) – construct gabion walls, drop structures and concrete bank armor to mitigate flood damage to susceptible community developments	Flooding	\$300,000	6/30/20	Director of Public Works		Deleted. New projects and priorities are being developed as part of the Surface Water Master Plan update.
Low	Plan and construct a central facility for the collection and redistribution of household hazardous wastes from residents of the community	HAZMAT	\$250,000	Starting 7/1/17, Ongoing	Director of Public Works		Deleted. HAZMAT not included as a natural hazard in new plan and the facility would be redundant with services offered by Cochise County.
Low	Coyote Wash Flood Control Project Phase 2 – construction gabion walls, drop structures and concrete bank armor to mitigate flood damage to susceptible community developments	Flooding	\$160,000	6/30/22	Director of Public Works		Deleted. New projects and priorities are being developed as part of the Surface Water Master Plan update.



**Table 6-1: PAST Mitigation Strategy for Sierra Vista**

Low	Retrofit all city buildings, as necessary, with equipment to reduce the impacts and damage of lightning strike on existing structures and equipment	Lightning	\$50,000	6/30/20	Director of Public Works		Completed and lightning hazard not included in new plan.
Low	Third Street Wash. Construct gabion walls, drop structures, and concrete bank armor to mitigate flood damage to susceptible community developments.	Flooding	\$170,00	6/30/2018	Director of Public Works		Deleted. New projects and priorities are being developed as part of the Surface Water Master Plan update.
High	Reuse treated effluent from the City's EOP for on-site equipment cleaning to reduce potable water use	Drought	\$400,000	6/30/19	Director of Public Works		Completed
High	Improve security at critical City buildings	Terrorism	\$2,000,000	6/30/19	Police Chief, Director of Public Works		Deleted. Effort is ongoing and terrorism not included as a natural hazard in new plan.
Medium	Consider programs to promote rainwater harvesting, water recharge, and other water conservation practices	Drought	\$100,000	Starting 7/1/18, Ongoing	Director of Public Works		Ongoing. Consolidated with another objective in new plan.

**Table 6-1: PAST Mitigation Strategy for Tombstone**

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)	Notes
High	Providing emergency back up electrical power for emergency service radio repeaters due to extended power failure from sudden violent thunder storms, which stretch all available electrical service to its limit.	Severe Wind, Lightening	\$5K	2020	Tombstone Marshal's Office/ Fire Department		The site is on generator back-up or battery UPS. Our Dispatch Center equipment does have a battery back up device that will hold us for a few minutes.
High	Design and construct improvements to roads that repeatedly sustain damage in flood prone areas and that have a high probability of leaving motorists or first responders stranded. Improvements will first be looked at along Charleston Rd.	Flooding	\$450K	2020	Public Works		Funding fell through. Remove.

**Table 6-1: PAST Mitigation Strategy for Willcox – UPDATE STATUS ON “NOTES” – COMPLETED? DELETE AND WHY? KEEPING?**

Priority Ranking	Description	Hazard(s) Mitigated	Estimated Cost	Anticipated Completion Date	Project Lead	Potential Funding Source(s)	Notes
High	Clean, maintain and improve water drainage through out town to prevent flooding. 1 <sup>st</sup> step to clean, then annually maintain Willcox’s drainage system is in desperate need of improvement involving engineering planning.	Flooding	\$20K	2021	Public Works Dept. Supervisor		
High	Review and update “Title 18 flood damage prevention ordinance” and municipal codes to help prevent flooding and maintain compliance with the NFIP Program.	Flooding	Staff Time	2021	Development Services / Supervisor		
Medium	Quail Park: Grading of drainages for water flow, installation of energy dissipaters such as rip raps and toe downs along drainages, as necessary.	Flooding	\$25K	2021	Public Works Dept. Supervisor		
Medium	Implement annual program relating to wildfire mitigation in City right of ways- Clean up parkways and property to reduce wildfire fuels	Wildfire	\$3K	2018	Fire Department/ Fire Chief		
High	Willcox plans to work with the public on reducing flying debris during high wind events. We plan to develop a public education campaign aimed at securing or eliminating items around	Severe Wind	\$3K	2019	Fire/Police Dept		

	the home and business that may cause damage during high wind events.						
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